Feb. 1929

Electrical Manufacturing

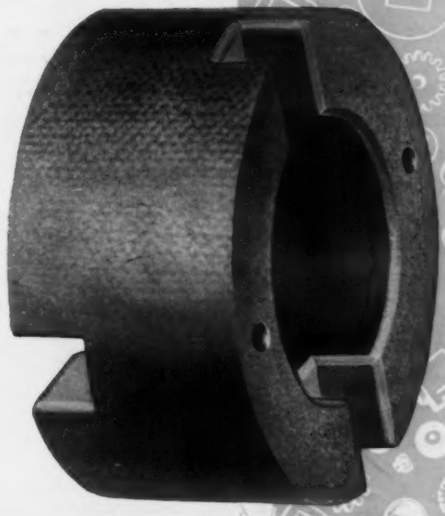
Vol. 3 A Gage Publication No. 2

Your Requirements ✓
Phenolite's Performance ✓
they must check!

—and they can be made to check 100 per cent if our Service Engineering Department knows what part laminated bakelite plays in the performance of your product.

Wastes in fabricating, inaccurate assembling or other inefficiencies are not necessarily the faults of your mechanics. Look to the material itself—or better still, have our Service Engineers study the problem from every angle. They will work with you in the development of a grade of Phenolite that checks *exactly* with the performance requirements of your product. And because we exercise full control over every process that goes into the manufacture of Phenolite, your future orders will conform to the letter with these specifications!

PHENOLITE
Reg. U.S. Pat. Off.
Laminated BAKELITE



To be specific—here is a coupling disc fabricated by "National" from a grade of Phenolite developed in our laboratory to meet the requirements of this specific application.

It possesses unusual tensile strength and resistance to wear. It is unaffected by oil and moisture; and, due to its fabric base, this coupling has valuable shock-absorbing properties.

NATIONAL VULCANIZED FIBRE COMPANY, WILMINGTON, DEL., U. S. A.
Offices in Principal Cities

YOU CAN HAMMER THE BELDEN SOFT RUBBER PLUG- IT WONT BREAK
Belden
The shank of the Soft Rubber Plug protects the cord at the worst wearing point. It also forms a handy handle for inserting and withdrawing the plug. Does not scratch or mar furniture.
The new Belden Heater Cord is so flexible that you can tie it in a knot or twist it into any imaginable shape without damaging it. Especially designed for severe heater service.

A *SUPER* Heater Cord with the Unbreakable Belden Soft Rubber Plug

An important addition to the Belden Cut Cord Service is the New Belden Heater Cord in conjunction with the Belden Soft Rubber Plug.

This New Belden Heater Cord far exceeds the standards of Underwriters' Laboratories for flexibility. It is so flexible that it will withstand years of wear in difficult heater service.

The neat appearance and long wearing qualities of the glazed cotton braid make this New Belden Heater Cord unusually popular with housewives.

The remarkable popularity of Belden Soft Rubber Plugs on radio sets, washing machines, vacuum cleaners and electrical refrigerators assures a hearty welcome for the Belden Soft Rubber Plug on Heater Cords.

Write today for sample of the New Belden Heater Cord with Unbreakable Soft Rubber Plug.

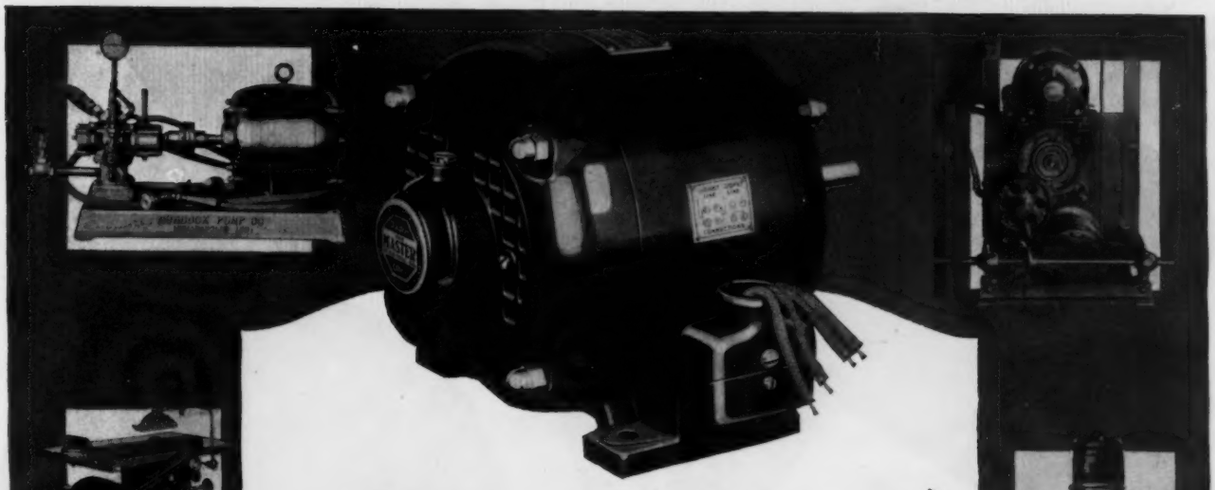
Belden Manufacturing Company

2310-B South Western Ave. **Chicago, Ill.**

BELDEN PRODUCTS

Beldenamel and Textile Magnet Wire
Coil Windings
Beldenmold (Molded Bakelite Products)
Automotive Wires and Cables
Airplane Assemblies
Radio Wires, Cords and Cables
Rubber Covered Wires
Armored Cables
Flexible Armature Wires
Motor Lead Wires
Braided and Stranded Copper Cables
Cotton Sleeving

Specify Belden



Appearance!

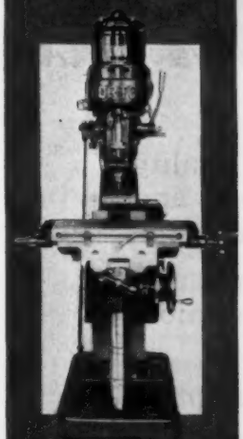
Appearance counts these days. The public have been educated to demand good appearance in anything they buy.

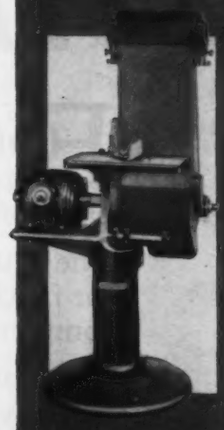
And we can't help saying it right here - we take just as much pride in the appearance of Master Motors as we do in any one of the many splendid Master qualities.

Symmetrical lines - - pleasing contours - - good proportions - - these are some of the ways people describe Master Motors.

Then there's the mirror black enamel finish which will not crack, chip or peel - an achievement that took seven years of intensive research on the part of Master Engineers. All Master Motors have it - a superb finish that will grace anything it drives.

THE MASTER ELECTRIC COMPANY
Dayton, Ohio



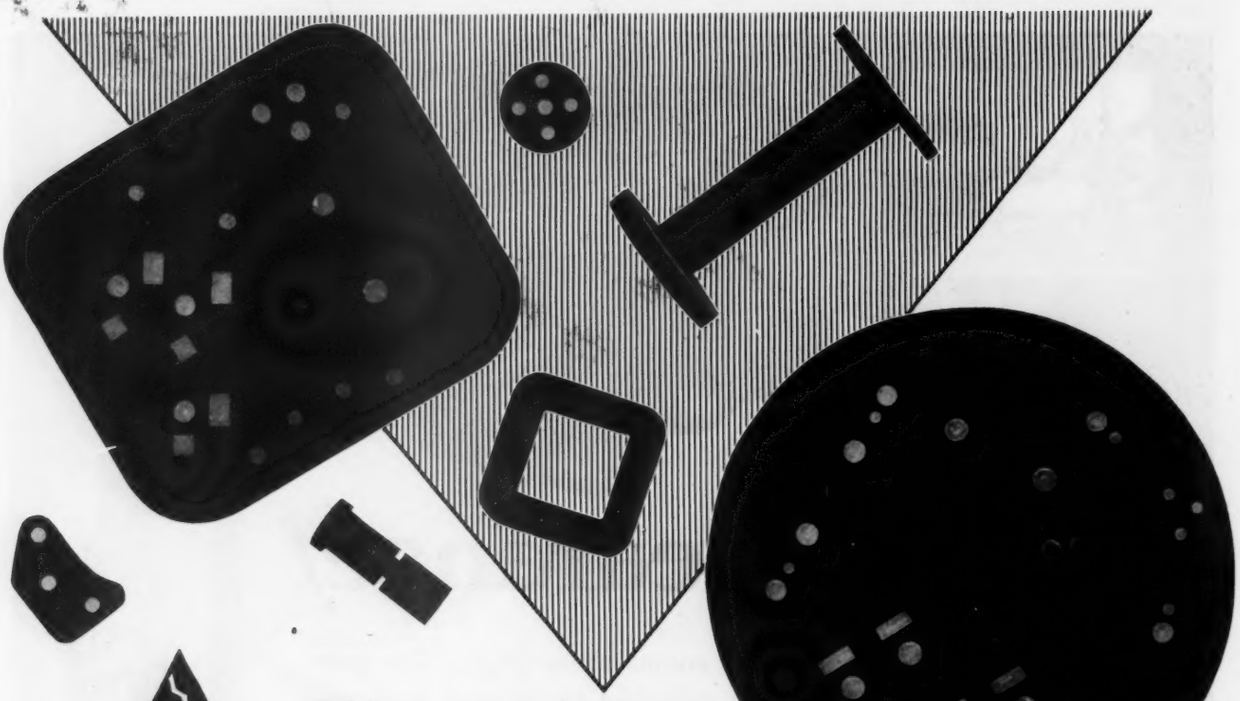


STOCKS CARRIED IN PRINCIPAL CITIES

More Than 70 Service Stations

MASTER GUARANTEED MOTORS

1/20 TO 10 H.P. Dayton THE MASTER ELECTRIC CO. Ohio **Less than 40°**



A Complete and Prompt Insulating Service

FORMICA provides promptly uniform and high quality phenol laminated insulating sheets, tubes and rods, and parts of any type that it is possible to machine from them.

The equipment both for producing the fundamental shapes and for machining them to your blue prints is the largest and most complete in the industry.

The Formica plant is centrally located where the promptest delivery is possible to the largest number of factories.

Send your drawings for quotations

THE FORMICA INSULATION CO.

4626 Spring Grove Avenue Cincinnati, Ohio

FORMICA

Made from Anhydrous Bakelite Resins

SHEETS TUBES RODS

Electrical Manufacturing

Reg. U. S. Patent Office

Volume 3 **FEBRUARY, 1929** **Number 2**

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H. L. Hildenbrand, *Managing Editor* — Leslie H. Allen, *Associate Editor*

William W. Baxter, *Associate Editor* — Roger L. Knight, *Associate Editor*

Irwin Robinson, *News Editor* — Edward H. Dutcher, *Production Editor*

Electrical Manufacturing's editorial program has the following objectives:

Production

To help all electrical manufacturers, including makers of motor-driven products, increase the product's salability, cut unit production costs, quicker turnover, reduce overhead expenses, establish standard methods of work, and spread a better knowledge of raw materials and parts.

Marketing

To spread a better knowledge of and aid electrical manufacturers in adjusting sales management to the buyers' market, to aid in making advertising more effective, finding the most profitable distribution channels, and promoting cooperative market development.

Administration

To further the working out of sounder management, policies and better executive control, coordinating sales and production schedules, promoting sales and production research, and developing better industry relations.

Repairing

To help all motor repair shops to build better business by developing a sounder organization, improving management, policies and methods, and developing a keener merchandising point-of-view on the business.

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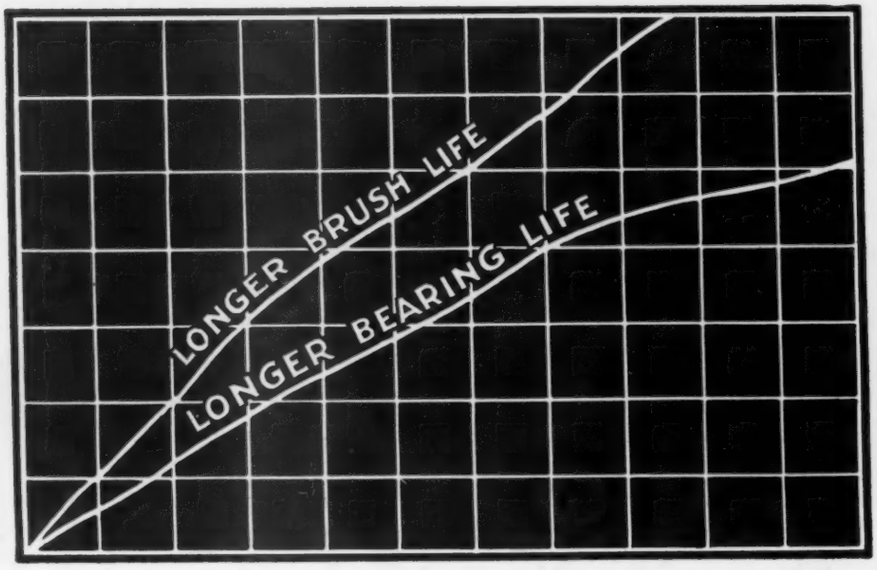
461 Eighth Avenue, New York, N. Y.

Chicago Office: 1742 Monadnock Block, L. C. Bassett, *Manager* — **Cleveland Office:** 501 Caxton Building, Harry Krohn, *Manager*

"More Power



WE put into every Dumore Motor this priceless ingredient — *over 25 years of experience in the development of Universal high speed motors!* It is a value you cannot see. And yet you have this value returned to you *day after day* and *year after year* in dependable performance.

Our experience has taught that only quality built *into* a product will *return* quality to the user. That is why more-than-average care and quality materials are used in the assembly of each motor. That is why each armature is dynamically balanced to ensure the deliverance of smooth, quiet, vibrationless power, with a minimum of wear on all parts. Dumore Motors, in the hardest of service in a wide variety of applications, have more than justified the faith and confidence placed in them by the Dumore engineers. Before definitely specifying any particular make of motor, investigate the exclusive advantages offered in the Dumore line. Then you too will become a Dumore user and enjoy such service and satisfaction as that mentioned on the opposite page by an enthusiastic manufacturer.

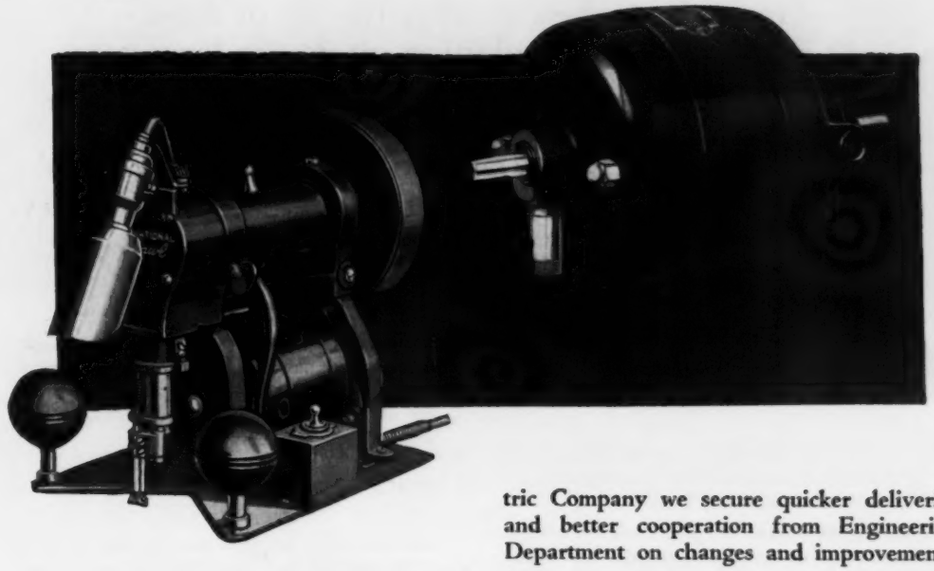
Because of our many years in the electrical motor field, we have developed a splendid organization for service and cooperation with our clients. Just how well we have succeeded in this endeavor is evidenced by the statements of Dumore users. One complimentary statement from a satisfied client is quoted opposite.

Dynamic balance of Dumore armatures is secured on special balancing machines of our own design and construction. Smoothness, quietness, and reduction of bearing trouble to a minimum are thus assured in all Dumore Motors.

DUMORE

and Life . . .

than the Motors we formerly Used "



THE International Register Company, Chicago, Ill., manufacturers of the International Cutawl, a mechanical cutter for the workrooms of display men, sign shops, scenic studios and pattern shops, use the Model C-1/16 H. P. Dumore Motor. Here's what they say: "We have found, not only that the Dumore possesses more power and life than the motors formerly used, but also that when dealing with the Wisconsin Electric Company we secure quicker deliveries and better cooperation from Engineering Department on changes and improvements.

Many manufacturers are now using Dumore Motors for operating window displays, special testing and calibrating machines, moving picture projectors, blowers, chiropodists' drills, grinding outfits for shaping crystals and lenses, and many other applications of this type. Dumore Motors obtain speeds of from 10,000 to 12,000 R. P. M., but they develop their maximum horsepower at 5,000 to 6,000 R.P.M. Write our Engineering Research Department for full details, and how efficiently the Dumore will work when applied to *your* product.

WISCONSIN ELECTRIC COMPANY

35 SIXTEENTH STREET, RACINE, WISCONSIN

FRACTIONAL HORSE POWER MOTORS

ARE DYNAMICALLY BALANCED!

FACTS

by which a publication's advertising worth is proven

Prestige is one thing .... longevity another....circulation quality still another—and all are very important. But when a paper has all of these attributes and in addition offers the largest number of individual company subscribers for good measure, that constitutes leadership. That's ELECTRICAL RECORD'S position after 37 years' outstandingly successful service to the electrical industry.

WIDE COVERAGE OF MARKET

Electrical Record has the largest *paid* circulation among individual company buyers of *any* electrical paper. (A. B. C. Statement of June 30, 1928.)

BROAD-GAUGED, AUTHORITATIVE AND INDUSTRY-ACCEPTED EDITORIAL PROGRAM

The highest renewal percentage *Electrical Record* has enjoyed continuously for many years proves reader acceptance of a well balanced editorial content. In *Electrical Record* will be found the highest proportion of editorial to advertising pages in any paper of record.

CONCRETE READER INTEREST ABSOLUTELY ESSENTIAL

Electrical Record easily surpasses any other known electrical paper in reader interest since its reader renewal percentage mark has been so much higher, consistently, for years. 74.84%. (A. B. C. Statement of June 30, 1928).

CONCLUSIVE ADVERTISER ACCEPTANCE

For years *Electrical Record* has most consistently carried not only the largest number of advertisers as a monthly, but the greatest volume of advertising directed to electrical buyers. Actual figures are available.

QUALITY CIRCULATION AS WELL AS QUANTITY

The subscribers pay 50% *more* to read *Electrical Record* than the next electrical monthly, or show preference to the extent of paying $21,798 more per year to read *Electrical Record*. This would certainly indicate preference and quality circulation.

37 YEARS OF CONTINUED DOMINANT LEADERSHIP IN THE ELECTRICAL INDUSTRY

For this long time period, the name "Gage" has been synonymous with publishing service to the electrical industry. *Electrical Record*, therefore, has a valuable industry background; a long established good-will.

Electrical Record

THE GAGE PUBLISHING COMPANY, Inc.

461 Eighth Avenue New York, N. Y.

The latest edition of the Gage List of Electrical Buyers is now ready for distribution. Reserve your copy now!

The Sentinel of Safety

Out of the darkness . . . a giant spectre . . . thrusting its nose fearlessly through the storm. Hours of flying over a raging sea . . . throbbing motors . . . dense blackness . . . then . . faint points of light ahead on the mainland. A new chapter in the stirring history of man's conquest of the air.

Every precaution has been taken in building and equipping the great ship . . . every chance of failure guarded against by the use of proven materials. And deep in the vital organs of the dirigible . . . the ignition and radio . . . Dudlo coils and wire, like unseen sentinels of safety, are doing their bit in making the great experiment a successful reality.

No test too severe, no strain too great for Dudlo magnet wire and coils. That great proving ground—aeronautics—has shown them superbly adapted to every requirement of the electrical and radio industry.

DUDLO

DUDLO MANUFACTURING COMPANY, FORT WAYNE, INDIANA

420 Lexington Ave. New York City | 105 W. Adams St. Chicago, Ill. | Division of THE GENERAL CABLE CORPORATION | 274 Brannan St. San Francisco, Cal. | 4143 Bingham Ave. St. Louis, Mo.

HORSE HEAD ZINC

FOR THE DIE CASTING INDUSTRY

UNIFORM QUALITY

The carburetor, nerve center of the automotive engine, is an intricate casting. Its thin wall sections, numerous openings, and close clearances demand a zinc base die casting alloy containing *uniform quality* zinc—Horse Head Zinc. ¶ There are numerous factors to be considered in all die casting production problems. But all these factors—economy, quantity production, machinability, and service—hinge on the prime essential of the die casting alloy—the *uniform quality* of the zinc base. ¶ Horse Head Zinc is the standard high-grade zinc because of the *uniformly high quality* it always maintains.

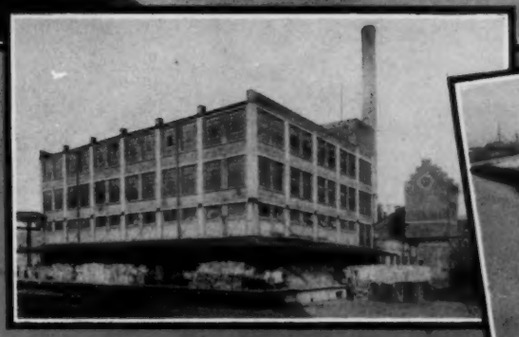
THE NEW JERSEY ZINC SALES CO.

160 FRONT STREET, NEW YORK CITY

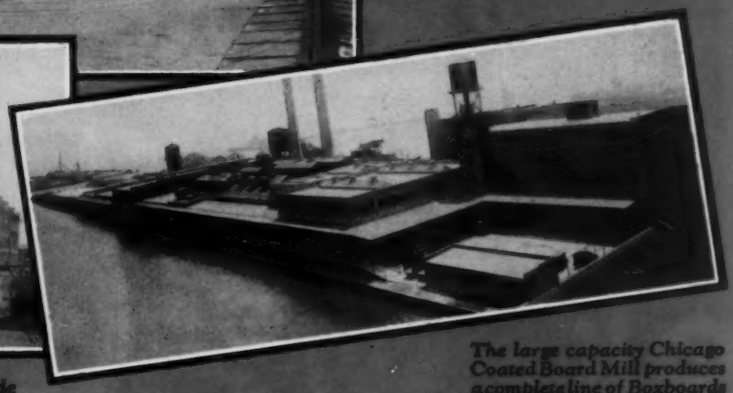
New Jersey zinc

ZINC METALS AND ALLOYS · ROLLED ZINC · ZINC PIGMENTS
SULPHURIC ACID · SPIEGELEISEN

Our Ogden Box Factories, Chicago, supply a large territory with quality Corrugated and Solid Fibre shipping containers and products.



Our Ogden Mill, Chicago, makes high-grade Test Liners and Chipboard for Containers.



The large capacity Chicago Coated Board Mill produces a complete line of Boxboards and Paperboard Specialties for Central, Western and Southern States.

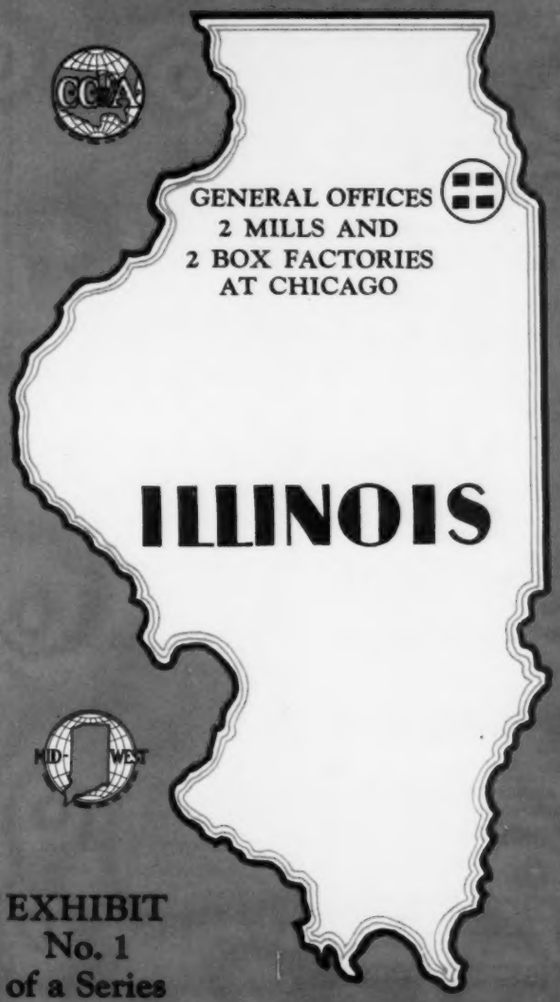


EXHIBIT
No. 1
of a Series

MILLS and BOX FACTORIES

(CORRUGATED, SOLID FIBRE and BOXBOARDS)

of the

CONTAINER CORPORATION OF AMERICA

and MID-WEST BOX COMPANY

IN ILLINOIS

THE Corrugated and Solid Fibre box factories at Ogden, our Chicago Division, ship their products broadcast over many states, primarily Illinois, Iowa, Missouri, Wisconsin, Minnesota, parts of Michigan and Indiana and states west of the Mississippi River as required.

Our Chicago Coated Board Mill distributes Boxboards for setup and folding boxes, paper tubes and cans throughout the Middle Western and Southern states, extending sales as far east as Buffalo, New York.

Our Chicago Ogden Mill manufactures Test Liners and Chipboard for shipping containers.

At Chicago, are also maintained our main Laboratory for Chemical and Physical Research, a large Machinery Construction division, a self-contained Rubber Die division and one of the largest waste paper plants in the country, the Pioneer Paper Stock Company.

This gives the Company control of important raw material sources and basic equipment which not only insure quality and perfection of products but also tend to reduce cost to consumer.

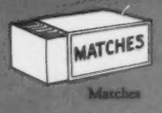
OTHER FACTORIES AND MILLS

at Cleveland, Ohio, Philadelphia (Manayunk), Pa., Fairmont, W. Va., Charleston, W. Va., Cincinnati, Ohio, Anderson, Ind., Kokomo, Ind., Circleville, Ohio, Natick, Mass., and Bridgeport, Conn.—

WILL BE FEATURED IN LATER INSERTS

A Great Variety of Goods — Fragile, Solid *and* Liquid Now Packed in Fibre Board Containers

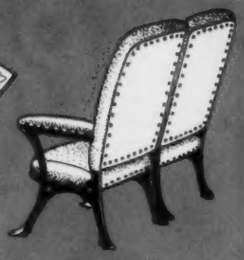
Pilferproof Recessed End Shipping Box



Matches

Shoes

Tobacco, Cigars Cigarettes



Open Chairs

Everything in Cans

Reshipping Case for Bottles and Bottled Goods

Toys — All Kinds

Lamp Wrappers

Electric Light Bulbs

Dry Cell Batteries

Soaps, Washing Powders and Flakes

Milk, Preserves, Etc.

Slotted Carton for all Commodities

A Clearing House for Better Boxes Combining Quality Economy and Ingenuity

THE unusually high rating of our Corrugated and Solid Fibre shipping containers among users of fibreboard boxes we attribute first to their outstanding Quality, and secondly, to their proved Economy. We have as far as is humanly possible eliminated guesswork in manufacture. As regards performance, we refer you to any one of our many clients. What our containers are doing every day for others—they can do for you. Always dependable, they have solved many hitherto troublesome packing and shipping problems for hundreds of shippers—and these problems may be yours. Write us when in need. See COUPON.

Some Industries Now Using Our Solid Fibre or Corrugated Boxes

Bakery Goods	Furniture	Shoes
Canners	Stationery	Breakfast Foods
Building Material	Lamps and Shades	Proprietary Remedies
Sporting Goods	Tobacco—all forms	Spices
Books and Magazines	Perfumery	Foods—All Kinds
Toys	Paints and Varnishes	Instruments
Crockery	Automotive	Brooms, Brushes, Etc.
Bottlers	Glassware	Ceramics
Fruit Packing	Insecticides	Leather Goods
Radio Goods	Rubber Goods	Doors
Pictures	Electrical Goods	Hardware
Vegetable Growers	Men's, Women's and Children's Furnishings	Dry Cell Batteries
Meat Packing		Enamelware
Dairy Goods	Millinery	Filing Cabinets
Soap and Chips and Washing Powders	Confectionery	Electric Light Bulbs
Matches	Carpets and Rugs	

CONTAINER CORPORATION
OF AMERICA
and MID-WEST BOX COMPANY

111 W. Washington St. **Chicago, Illinois**

Six Mills — Twelve Factories — Capacity over 1200 tons per day

RETURN COUPON

CONTAINER CORPORATION OF AMERICA
111 West Washington Street, Chicago

Gentlemen: Please have one of your experts check our present packing and shipping methods—without obligating us—for the purpose of reducing our costs if possible.

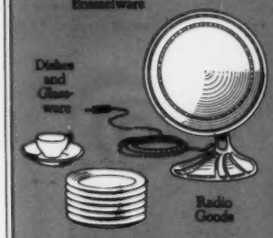
Name_____

Title_____

Firm_____

Address_____

Pottery and Enamelware



Dishes and Glassware

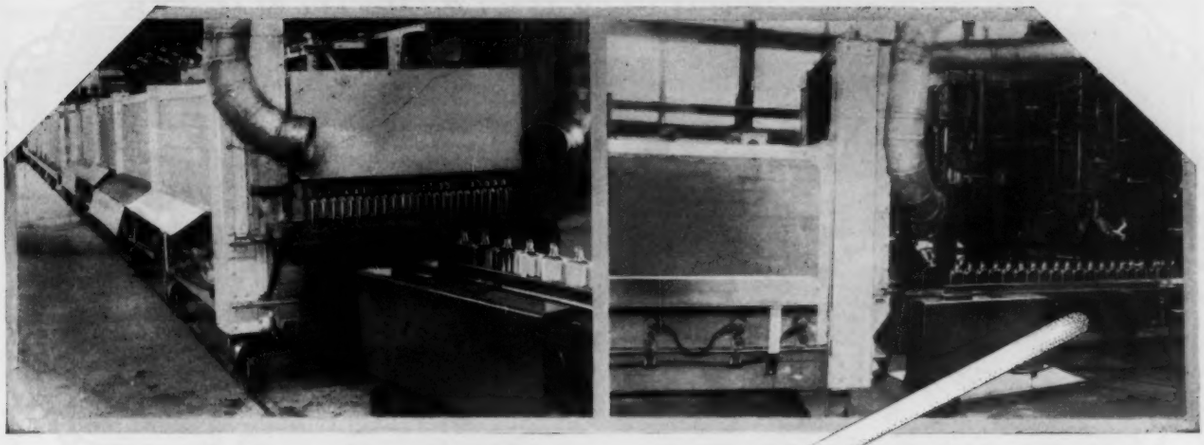
Radio Goods

Electrical Goods

Reflectors

Enameled Tile

Wherever goods are manufactured — there you will find our boxes reducing packing and shipping costs.



Globar

In a plant where they make 1,400,000 bottles a day

GLOBAR, the non-metallic electric heating element, brings a clean, uniform, perfectly controlled heat to the lehrs used in annealing small ware at the plants of the Illinois Glass Co.

These lehrs are 80 feet long and are operated at a temperature gradient ranging from 1100° F., in the hot zone, to practically room temperature at unloading end.

Globar elements have been decidedly instrumental in making possible consistently good annealing and, because of the ease and rapidity with which a Globar element can be removed and installed, while the lehr is in operation, Globar elements ensure a uniform and continuous production flow in these notable installations.

OUR ENGINEERING DEPARTMENT WILL GLADLY GIVE YOU COMPLETE INFORMATION REGARDING GLOBAR ELEMENTS AND THEIR APPLICATION

Send for Bulletin D-7

(Globar is the registered trade name given to non-metallic electrical heating and resistance materials, and to other products of Globar Corporation, and is its exclusive property.)

GLOBAR CORPORATION, NIAGARA FALLS, N. Y.

Do you make these

Bells
Buzzers
Annunciators
Relays
Burglar Alarms
Battery Chargers
Magnetos
Distributors
Cut-outs (*auto*)
Electric Clocks
Motor Controllers
Sign Flashers
Thermostats
Tachometers
Time Switches
Tank Alarms
Voltage Regulators
Electric Heat Control, *etc.*

WILCO
Contact Points

WHATEVER it is, and if it incorporates thermostatic metal or contact points, there may be a problem relative to the correct application of these two important materials.

WILSON has proved that such problems require *specific* treatment—one material cannot be expected to fit many applications.

WILSON is always ready with a service that finds the *final* answer to the question, "what and how to use it."

THE H. A. WILSON CO.
97 Chestnut St., Newark, N. J.

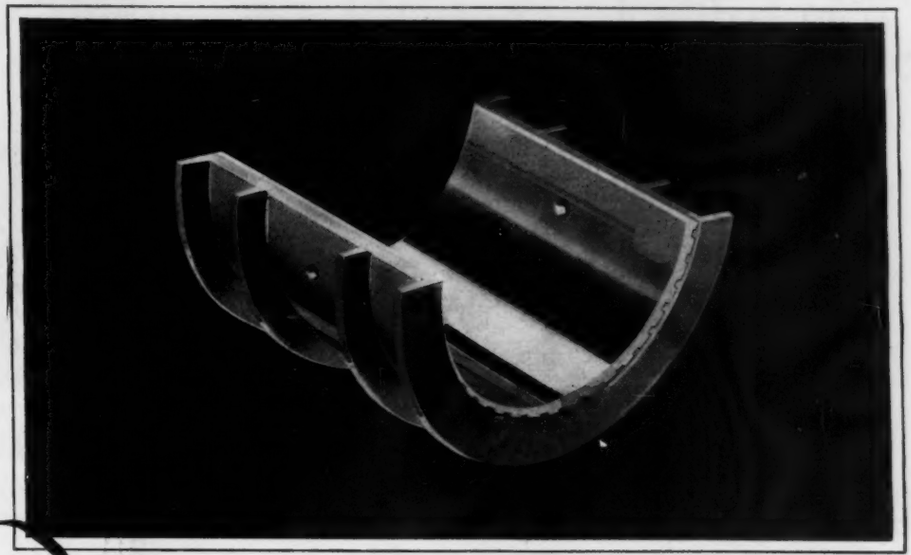
Refiners and Workers of
Platinum
Silver *and*
Other Precious Metals

Temperature Control for—

Heat Pads
Water Heaters
Electric Ranges
Percolators
Toasters
Refrigerators
Ice Machines
Electric Heating Systems
Electric Cookers
Pottery Kilns
Electric Furnaces
Glue Pots
Irons

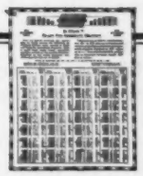
Electrically Heated
Ironing Machines
Hair Wavers, *etc.*

WILCO
Thermostatic Metal



Who but a Specialist

COULD MAKE THIS FINE BEARING?



WHEN the world's leading manufacturers of motor vehicles and machinery require top quality bronze bearings, they consult the bronze bearing specialist.

Johnson Bronze designers, engineers, molders and machinists have specialized in their respective arts for over a quarter century. During that period they have served successfully every division of industry.

The result is that your particular bronze bearing problem at Johnson Bronze receives the treatment to which it is entitled—adequate, sensible and in keeping with modern engineering practice.

If the sizes and types you require are not among the six hundred listed on this wall card, a JOHNSONEER will call at your request to discuss your bushing and bearing problems without obligation.

JOHNSON BRONZE COMPANY, NEW CASTLE, PA.

New York, Chicago, Detroit, Cleveland, Kansas City, San Francisco
Export Address—142 W. 42nd St., New York City, U. S. A.
Cable JONBRON

JOHNSON BRONZE

BUSHINGS BEARINGS BAR BRONZE

STAND-BY,* *n. One who, or that which, stands by one in need; something upon which one relies for constant use.*
ACCORDING TO WEBSTER

Knitting the baby's mitten; darning socks for Dad; making old fashioned pumpkin pies; always sympathetic with the whole household; lending a helping hand in a million ways—Grandmother is a dear, old stand-by* who never fails to do her part.

In most every household there is another faithful stand-by* that percolates the coffee, browns the roast, and warms chilly feet—and that is *electric heat* generated through heating-elements of Chromel. This original nickel-chromium alloy has been a faithful servant in the home for 23 years. To the manufacturer of the heating-device, to the dealer, to the user, Chromel is a good, old stand-by.*

With Chromel elements you will find that your heating devices give good service. You will also like Chromel's mechanical properties—its even stretch, its correctness of temper and its smooth finish. You will like its uniformity of resistance, that accurately fits the catalog values.

If you are now using Chromel, we are telling you things you already know. You know, too, that Chromel is not always quite what it ought to be, but that its average quality is more than merely "good."

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MEANS ELECTRIC HEAT

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THE WIRE THAT MADE ELECTRIC HEAT POSSIBLE

Torrington Ball Bearings

THE invention of the ball bearing placed a powerful asset in the hands of machinery builders. Likewise, it has given an impetus to the demand for machinery that performs consistently.

Torrington Ball Bearings enable you to take advantage of this demand . . . to capture the attention of users who insist upon the ultimate in smoothness and ease of performance.

The reason for Torrington Ball Bearing excellence lies close to hand. It is the unparalleled record of accomplishment of the Torrington organization in the field of precision manufacture.

The Torrington Company
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A new development that can be used by 1000 industries

BOHNALITE

62% LIGHTER THAN IRON

Bohnalite as a light alloy is new only by comparison.

As time is reckoned, iron is an old metal. On that basis, Bohnalite is a new metal.

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Bohnalite has high and uniform hardness.

Bohnalite has great density.

Bohnalite has a fine grained structure.

Bohnalite has exceptional strength.

Bohnalite is ductile.

Scores of leading manufacturers in a wide variety of industries have replaced iron with Bohnalite *most advantageously.*

Over 1000 industries can still use Bohnalite and do not know it.

Those who are using this new alloy did not realize what a vast improvement Bohnalite would make until they investigated. That's exactly what we are asking you to do.

If you use a heavy metal in your product, let our engineers talk to yours.

We have developed a whole series of special processes. All of these are explained and the finished products illustrated along with detailed physical properties in a new book we have just published.

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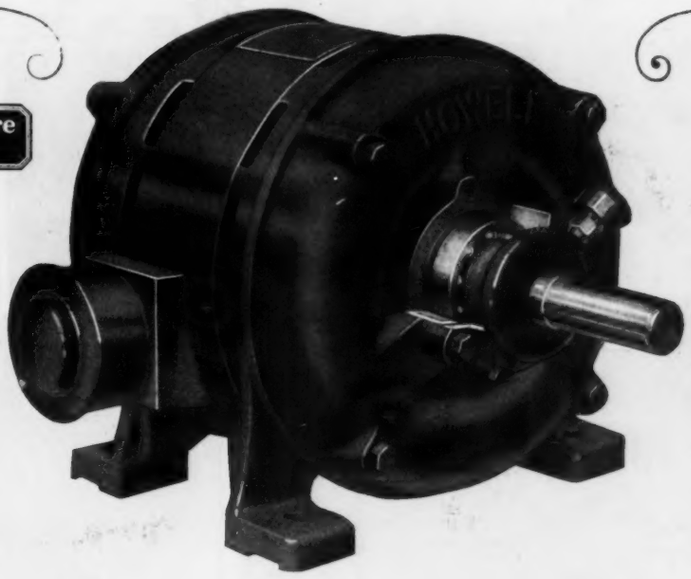
CHAS. B. BOHN
The authority who developed Bohnalite

THE WORLD'S GREATEST AND LATEST LIGHT METAL



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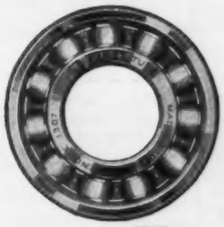
HOWELL "Red Band" Motors of the higher speed type are equipped with New Departure Ball Bearings —another of the more than fifty manufacturers of general purpose electric motors using ball bearings as optional or standard equipment.

Howell uses New Departures because of the fact that the electric motor will not retain its full efficiency electrically unless it also *retains its efficiency mechanically.*

New Departure Ball Bearings not only assure *peak* mechanical operation but are a guarantee that such efficiency is built to last.



New Departure Ball Bearings

The New Departure Manufacturing Co.
Bristol, Connecticut
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G-E Flex Cord

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Household Appliances

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The use of G-E Flex eliminates the kinks and tangles which cut down efficiency of office appliances. That's why so many manufacturers have adopted it.

G-E Flex is also being used extensively on garage tools, electric drills, vacuum cleaners, lamps, washing machines and many more household and industrial appliances.

It is all-rubber covered and extremely flexible. Neither acid, oil nor water will harm it. It resists abrasions and has high tensile strength. It is obtainable on spools or in cord sets with moulded rubber plug permanently attached, ready for assembly. If you send the coupon, we shall gladly give you further details.

Section W-232, Merchandise Department,
General Electric Company,
Bridgeport, Connecticut.

Send me complete information about G-E Flex all-rubber electric cord and cord sets.

Name .....

Address .....

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GENERAL ELECTRIC

Electrical Manufacturing

Production - Marketing - Administration - Repairing

Volume 3 FEBRUARY - 1929 Number 2

Safeguards on Time Sales

By Enoch B. Seitz*

Executive Secretary, American Washing Machine Manufacturers Association

WHAT constitutes the safeguards that should be thrown around the conduct of a deferred payment plan of merchandising?

(1) If such a plan is to work out successfully, it must be applied to a product that will have a longer life by far than the length of the contract.

(2) It should be on a product that is not just being exploited, but on a proved product. The product should be made by a permanently established manufacturer—a manufacturer sufficiently capitalized to insure his permanency in his industry.

(3) The next safeguard must be sane terms—terms that the ordinary ups and downs of business, the peaks of prosperity or the valleys of depression cannot seriously affect.

(4) Another aspect of the term phase question is that the sooner the purchaser of the appliance or the creator of the paper is rushed into genuine equity in the product, the safer that paper becomes. For the most part, terms have been corrected in deferred payment selling. That does not mean that you cannot pick up a newspaper and see where you can buy a radio for two dollars down, a vacuum cleaner for two dollars down, or a sewing machine for five dollars down, with fifteen to twenty months in which to pay the balance. But, in nearly every instance, if you will note, the people who are offering such terms are people who are not doing business with finance companies. They are department stores, installment furniture houses, or public utility companies, who have their own funds and their own collection machinery, which they consider adequate to cope with the undoubted risk which is incurred in offering these terms.

(5) The next item that goes for the making of prime paper is the credit investigation that precedes the delivery of an appliance on order of the sales department. It is my observation that nine-tenths of the repossessions can be eliminated through the rigidity of that credit investigation. This rigidity of credit investigation means knowing the environment and the general moral risk of the would-be purchaser, his income and his pledged outgo; to know if he is buying his washing machine while he is already paying for a radio and an automobile, or if he is buying his radio and still owes on his vacuum cleaner and washing machine; to be sure that he is not pledged beyond what is humanly possible for him to pay out of his income. Again, has he sufficient income to pay in ten, twelve or fifteen months for the merchandise he has selected?

(6) Next, paper is not prime unless the dealer has set up within his own organization a most vigilant collection department, one which proceeds under the theory that the first ninety or the first hundred and twenty days' collections really determine whether or not that sale is a permanent sale, one which seeks to prevent a repossession from occurring too late to obtain the maximum salvage from it. Repossessions are always costly, but much of the loss can be eliminated if the collection department is functioning properly. By functioning, I mean they are either getting the payments reasonably up to date, or the goods.

(7) Again, primeness of paper must take into consideration whether or not the price level of the appliance from which the paper emanates is to remain on a more or less even keel, whether it is on merchandise that does not have violent price fluctuations. How would you like to have paper on radios that sold at $225 and then within thirty, sixty, or ninety days' time, have that same merchandise offered at a price cut to $110? What would happen to the paper based on the previous price? Customers buying at the top price would say, "Come get your radio, at the new price we can afford to lose what we have already paid."

(8) Next, primeness of paper depends on the responsibility of the dealer. Any plan of financing that eliminates the dealer from responsibility is riding to a sure fall. The so-called non-recourse plan of which we heard so much five years ago and even up until a year ago, is "out the window" today. It taught the dealer a false standard. It sought to approach him on the soft side. No responsibility on his part meant temptation to create that which he would not have created had there been a sense of responsibility. There must be dealer indorsement.

The manufacturer is fast getting out of the picture as an indorser of paper. It is pretty generally proved that if a manufacturer has to assume the responsibility asked of him formerly as a co-indorser of the paper, if he has to continue to do that and assume the risk of say ten per cent of the total sales as repossessed, he might as well be running his own stores, because his is the risk and not the dealer's. The manufacturer has sought to eliminate himself from the picture, appreciating that he is a manufacturer and not a banker.

*From an address at the thirty-third annual meeting of the Central Division of the National Electrical Credit Association, Chicago.

The Airport Market for Electrical Equipment

Black and orange figures on this map represent 1195 existing and 800 proposed airports, respectively. Of existing airports 260, or 22 per cent, have lighting equipment. Six per cent, or 75 are adequately lighted

Electrical contractors, general contractors, central stations, municipal committees, transport companies, Chambers of Commerce, city engineers and airport corporations buy this electrical equipment for airport installations

The Aviation Market

What It Is—Where It Is

Photo by Joseph Capitaine

H. L. Hildenbrand

"Inspection of typical airports in Chicago, Springfield, and Buffalo reveals a common inadequacy of electrical equipment"

The potential market for electrical equipment in aviation is 900 unlighted airports, now operating, 800 proposed airports, and numerous airways

BY H. L. HILDENBRAND
Managing Editor,
ELECTRICAL MANUFACTURING

AND

ROGER L. KNIGHT
Associate Editor,
ELECTRICAL MANUFACTURING

Photo by Joseph Capitaine

Roger L. Knight

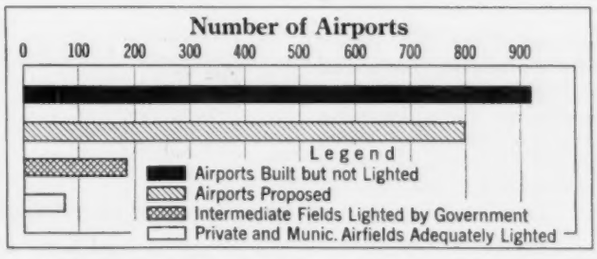
"Interviews with Department of Commerce officials support the conviction that a vast electrical market is growing in the 'air'"

ELECTRICAL equipment for an intermediate landing field, lighted by the United States Department of Commerce, represents an expenditure of about $5,000. This does not include interior lighting of buildings, communication equipment, shop equipment, and miscellaneous items. Considering all equipment, it is estimated that an adequate airport will require from $8,000 to $10,000 worth of equipment. At the rate of $10,000 per airport, the total business for the 1720 unlighted and proposed airports is $17,200,000.

Intermediate landing fields lighted by the Department of Commerce serve as a guide in estimating the extent of the electrical market in municipal and private airports. As mentioned in the paragraph above, the adequate municipal airport requires much more electrical equipment than an intermediate landing field, because the intermediate landing field provides only a beacon for locating the field, and lighting equipment enough to enable fliers to make emergency landings. These fields do not provide hangar facilities, waiting rooms, shops, administration buildings, etc.

Equipment for municipal and private airports is bought in various ways. At Greensboro, N. C., the purchase of equipment was supervised by an engineer and a purchasing agent for the city. Equipment for the airport at Richmond was purchased through the department of public utilities. The airport corporation bought the equipment for the airport at Schenectady, N. Y. For the airport at Augusta, Ga., equipment was purchased by a purchasing agent. The local power company purchased and installed the equipment on the airport at Peoria, Ill. An electrical contractor furnished the equipment for the airport at Worcester, Mass. At St. Joseph, Mo., equipment for the airport was purchased by the superintendent of the air field. At Ponca City, Okla., airport equipment was bought by an aeronautical committee of the Chamber of Commerce. At Wichita, Kan., equipment was purchased by a building association. At Spokane, Wash., floodlight and beacon were purchased from an electrical supply house, wiring for the beacon was furnished by an electrical dealer, and wiring for the floodlights by a dealer contractor; all purchases being made under the direction of the city commissioner. At one airport in Kansas City, the director of public works has charge of all purchases. In Miami, Fla., the city electrical inspector was in charge of all purchases of electrical equipment for the airport. Purchases of equipment for all government airways are made by the United States Department of Commerce, Bureau of Lighthouses. This equipment, including all but miscellaneous construction materials, is then turned over to individual contractors for installation on the airport.

The significance of the growing aeronautical market to electrical manufacturers depends upon the extent of the market now, and its probable growth.



The potential market for electrical products sold to airports alone is indicated by adding together the two long bars on the above chart. Besides this market, there is one for airway beacons, landing lights and radio on airplanes, and many other items

Figures given here indicate the extent of the market now. Some index of future growth may be obtained by considering such things as the increase in manufacture of airplanes, activity of the Department of Commerce in lighting airways and promoting civil aviation, both day and night, and developing and promoting the use of communication equipment; general increase in night flying, and development of air passenger lines and air transport companies. Airplane manufacturing companies are swamped with orders, and new companies are springing up. According to figures published by the Department of Commerce, over 800 new airports are proposed. Two thousand more miles of airways will be lighted by the Department in the remainder of the 1929 fiscal year. New airlines are being started, many of them international. Individual business men and corporations are buying planes for private use.

"It is obvious," says the Department of Commerce, "that general flight in all phases is already here and doing business. Every town will undoubtedly have its operators and private owners of aircraft which must be serviced just as automobiles, motor boats, and other transport mediums. The first airplanes in any town mean some degree of airport."

It is further generally understood that with the long distances prevailing in the United States, night flying will be almost as common as night travel on the railroads. There must be airports, and there must be night flying; the result is obvious.

Many Airports Inadequately Lighted

ANOTHER matter of importance to electrical manufacturers making equipment for airport lighting, is that of selling. This equipment must be sold, just as street lighting equipment or commercial and domestic lighting equipment must be sold. Many airports that are now being used for night flying are inadequately lighted, and others can be considered adequate only for the type of service they are now giving, and would broaden their service if they had the proper equipment. Just as adequate lighting is replacing inadequate lighting in other fields, so will it in the field of aviation. Now is the time to sell adequate electric lighting equipment to the promoters of airports, because the majority of these ports have no lighting equipment at all. Once they have lighting equipment of any kind, it will be difficult to make additions or improvements and a much harder selling job will confront the electrical manufacturer.

In the opinion of a famous war flier, who has made a survey of airports in this country, night lighting equipment should be one of the first considerations in equipping an airport. "Simple, self-supporting lighting equipment is now available," he says, "and should be one of the first expenditures made. Nothing is so gloomy as an unlighted, sleeping airport. Public enthusiasm sleeps with Lethe and the airmen on a dark field. It is a safe prediction that night flying will almost equal day, just as soon as the problem of inexpensive night lighting, now available, is recognized and installed."

This is typical of the spirit of airmen all over the country. They believe in night flying, and are promoting the use of every means to make it more successful. Air marking has been repeatedly urged by long distance fliers, including Arthur Goebel and Colonel Lindbergh. Industrial plants everywhere are urged to paint on the roofs of their plants signs and arrows indicating the name of the town in which they are located, and the direction of the nearest landing field. These markings should be illuminated for night flying. Airway beacons, also, are now being installed by private enterprises. Most of these are intended to serve the dual purpose of lighting airways and as an advertising device for the enterprise installing them. A beacon was recently installed on the top of a theater building in a small town in Pennsylvania, at a cost of ten thousand dollars. This is a new field which is bound to grow.

(*Continued on page* 59)

TABLE I—Three Typical Airports Compared with Suggested Adequate Electrical Equipment

Electrical Equipment of an Adequate Airport	Springfield	Buffalo	Chicago
Field Lighting Equipment			
Airport Beacon	x	x	x
Course lights	0	0	0
Flashing mechanism	0	0	0
Sun switch	0	0	0
Steel switch cabinet	x	x	x
¾ in. galvanized service cap	x	x	x
¾ in. galv. conduit	x	x	x
Strain insulators	x	x	x
1000-watt lamp (beacon)	x	x	x
2 500-watt lamps (course lights)	0	0	0
Wind indicator	x	x	x
Wire and cable	x	x	x
Boundary lights	x	0	0
Obstruction lights	x	0	x
Hangar floodlights	0	x	0
Ceiling projector	0	0	x
Landing floodlights	x	0	x
Interior Lighting Equipment			
Pilots' quarters	0	x	x
Waiting rooms	0	0	x
Administration building	0	x	x
Offices	0	x	x
Rest rooms	0	x	x
Restaurant	0	0	0
Repair shop	0	x	x
Hangar	0	x	x
Post office	0	0	x
Storage supply rooms	0	x	x
Express office	0	0	x
Baggage and parcel room	0	0	x
Fire department	0	x	x
Communication Equipment			
Telegraph equipment	0	0	x
Telephone (outside)	x	x	x
Telephone (intra-airport)	0	x	x
Radio transmitting	0	0	0
Radio receiving	0	0	0
Fire alarm system	0	x	0
Shop Equipment			
Cranes and hoists (motors)	0	x	0
Trouble lamps	0	x	0
Lathes	0	x	0
Drill presses	0	0	0
Grinders	0	0	0
Hack saws (machine)	0	0	0
Welder	0	0	0
Soldering irons	0	x	x
Beading machine	0	0	0
Hand drills	0	x	x
Sewing machine	0	0	0
Garage tools	0	x	x
Arbor press	0	0	0
Forge	0	x	x
Miscellaneous Equipment			
Fire siren	0	x	0
Ventilating equipment	0	x	0
Heating equipment	0	x	x
Power transformer	x	x	x
Fuel and oil pumps	0	x	x

The equipment listed in the above table is not that which is found in any particular airport. It represents the equipment necessary for an airport containing all the buildings and services a busy airport requires. An "x" in the table means the airport has the item of equipment opposite the x

Men Still Respond to a Square Deal

"Better environment, both in the home and in the manufacturing plant cannot but mean better satisfied workmen, and the better satisfied workman does a better day's work."

An Interview with

ALBERT I. APPLETON

President and Treasurer,
Appleton Electric Company

By LEON I. THOMAS

Albert I. Appleton
President and Treasurer,
Appleton Electric Company

"ARE you constituted for the job?" That's invariably the question that Albert I. Appleton puts to young men who come to him seeking advice about entering a career. Perhaps he had asked himself that same question twenty-five years ago when he started in business for himself by founding the Appleton Electric Company.

If he did thus quiz himself he must have answered in the affirmative. Both his previous experience in working for others and his subsequent handling of his own business affairs show "yes" to be the correct answer, written in capital letters.

When at the age of fifteen he began an apprenticeship as die and tool maker, Appleton made up his mind that he would be in charge of men before he was 21 years' old. "And I was," Mr. Appleton told me modestly as we sat in his spacious, many-windowed office of his Chicago plant one day recently. What better qualification to head the list of those required by the leader of a manufacturing institution, I thought to myself, than that of ability to handle men.

That this trait in the man has been a large factor in the building up of his present loyal organization of some 600 persons in Chicago and another 150 in his malleable foundry in South Milwaukee is easy to believe when he explains and amplifies his views on management.

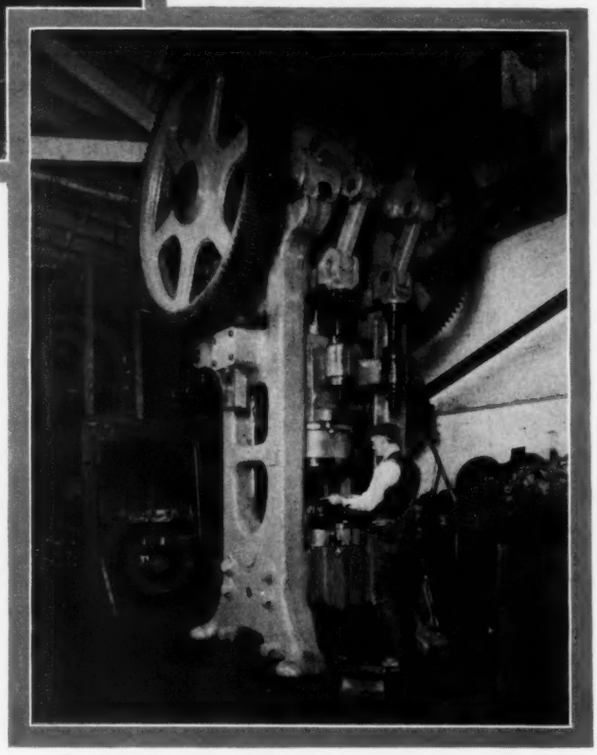
A few prominent executives have recently told me that labor is easier handled today than formerly because they are better enlightened on the fundamentals of economics—in other words, because they have today a better conception of what business is all about. I thought perhaps that Appleton was going to chime in with this thought, but not at all. Rather, he showed himself the born leader of men by saying, "Labor has always been easy to handle. True, times have changed and this has brought new standards of living and new environments, but men respond now to the square deal as always.

"Time was," he continued, "when a larger proportion of the workers were comparatively fresh from the monarchies of Europe, and consequently the lines of king and serf—of master and servant—were more sharply drawn than at present. And that meant that the capital-vs.-labor structure revealed its ugly framework more prominently than at present, when the true mutuality of interest is more apparent to all.

"A better environment both in the plant and in the home which has come with the increased standard of living cannot but mean better satisfied workmen, and the better satisfied workman does a better day's work. Give a workman more sunlight in the workrooms, give him cleaner conditions and he is sure to form better habits—better habits of work as well as of play. Better working conditions are the best cure I know of for careless, slovenly workmanship.

"When Henry Ford first established his five-dollar-a-day minimum wage, what a furore it kicked up among employers everywhere. Somehow I couldn't share in the alarm, for it has always seemed to me that the more wages you can afford to pay the better it is for mankind. To show that

AT the left is a scene in the plant of the Appleton Electric Company of Chicago, showing one of the large baking ovens in the enameling department. At the left of the oven is an endless conveyor so equipped as to permit of a very steep ascent. Below is one of the large punch presses in the Appleton plant, which Mr. Appleton explains was too large for existing requirements when it was installed, yet today conditions are such as to require even larger presses, which tends to show the advantages of foresight in planning for new equipment



we practised what we believed, we were, so far as I know, the first electrical manufacturing company in this section of the country to close our plant at noon on Saturdays. And, wholly aside from any altruistic angle of the thing, it paid and paid well, I believe."

On a trip through the Chicago plant a day or so before I saw Mr. Appleton, I was attracted by the neat battleship gray on each and every machine. Nor was this a touch of gray peeking out here and there from under a coating of grease and dirt. So I asked about it when I got to headquarters. "We keep two painters busy continually, outside when the weather permits, and inside the rest of the time. And then we keep the surfaces clean that we paint.

"In some of our stairways we have painted the walls and ceiling with aluminum paint, which we find reflects the light well and gives a cheery effect to areas that are too often rather dismal. The impression that all this painting gives to the employes cannot but be reflected in quality of workmanship.

"And that goes for clerical help as well. I'll wager you can't find a scratched-up, worn-out desk top in the offices. These same painters have the office furniture under their watchful care."

Now that we were off on a discussion of equipment I thought the subject of handling labor had been dropped, but it is too important a part of good management in Mr. Appleton's opinion to be treated lightly. So he picked up the thread again with the remark, "A lot of my friends argue with me that labor should come down with its wage scale. But I don't agree at all. Produce more per man, but save the wages, is the way out." Raise the wages and cut the costs are entirely normal twins in Mr. Appleton's management philosophy—incidentally a philosophy well considered by many leaders in American industry today.

As most everybody in the electrical business knows, the Appleton Electric Company makes today electrical conduit fittings, chief of which are unilets, in which line are included threaded steel conduit fittings, threaded malleable conduit fittings and the latest improved no-thread type of malleable unilets, which eliminate the threading of conduit pipe. The electrical line consists of miscellaneous types of conduit fittings as well as outlet boxes, covers and numerous other specialties.

The reelite, a handy extension light on a reel, and also the autoreelite, a reel spotlight, are other well-known products made by this company.

But way back twenty-five years ago when the business was started and Mr. Appleton's force of two workmen did all the manufacturing of the original line, which consisted of fuses, fuse wire, links, telephone fuses, and the like, these same broadminded policies of management were apparently in Mr. Appleton's mind. The point is that management policies in general are not like suits of clothes that have to be discarded entirely and new ones bought as the boy grows up. Fundamental policies of management hold good in small plant and large, and in motor manufacturing plant or insulated wire factory. That's why Mr. Appleton's observations on management seem to be of broad interest and value.

Just a simple question about the advisability of junking old equipment brought a perfect torrent of excellent advice from Mr. Appleton on this and developed that he feels very keenly the wisdom not only of maintaining equipment at a high level of efficiency but of discarding equipment long before it dies a natural death, if, in the meantime, equipment with greater cost-cutting possibilities is on the market.

"This thought got a sudden rejuvenation with me," says Mr. Appleton, "when I was visiting the plant of one of the largest electrical manufacturers in Germany a year or

so ago. Here they were turning out stuff on old inefficient equipment and, consequently, at high cost. A query to the German executive brought the answer that they were perfectly aware of the handicap but that they could not afford new equipment.

"This was undoubtedly so, but I wondered then, and have been wondering ever since, if they really would junk that machinery even if they could afford new and up to date equipment. There is something born in some people that makes them hold on to equipment just because there is still some life left in it. They seem to feel that it is a sign of weakness or of extravagance to junk that which still has a spark of life, whereas just exactly the opposite is the truth.

"As everyone knows, it is in this readiness to junk old equipment for new that has put America where it is industrially. We try conscientiously to put this thought to work in our plants and so are ever watchful for equipment that will do a better job than that which we have and at a lower cost. And when we find it, out goes the old. Sentiment or ideas of false economy are not allowed to stand in the way."

"Sometimes it is an improvement in mechanism which makes for greater speed and hence greater output. Or it may be that the size of a machine may be the limiting feature. Too small a machine may balk when larger and ever larger pieces of work are assigned to it. When we approach such a situation we feel that we would be falling far short of our management obligations not to see to it that the size and capacity of equipment is kept several steps ahead of needs.

"With us this is particularly true as regards punch press equipment. With the larger sizes of outlet boxes came greater demands upon the presses. This led us early into installing some large presses—perhaps larger than we needed at the time, but the wisdom of the choice has later been proved.

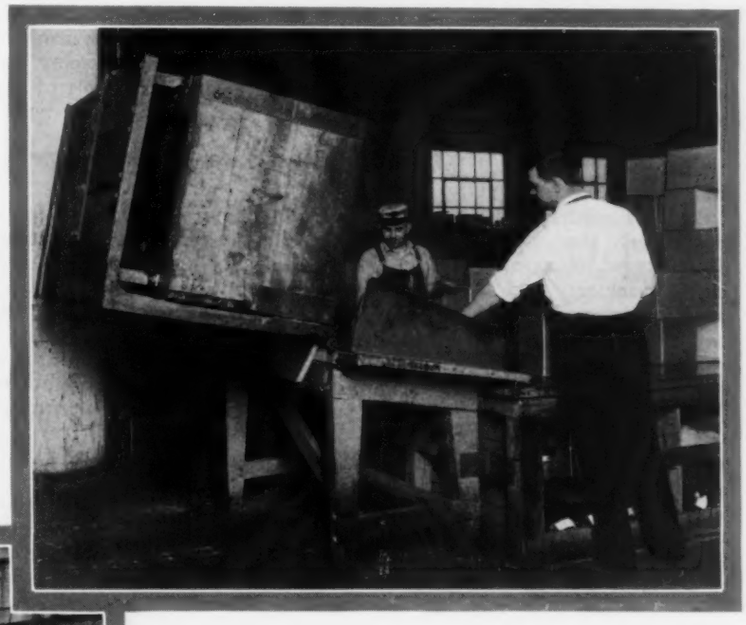
"Perhaps no single branch of equipment has undergone a wider adoption and adaptation during recent years than have materials-handling devices. We have been mindful both of this and also of the fact that some handling methods lend themselves well to one type of product and others to others. With us, we have put large stress on caster-mounted tote boxes and also on caster-mounted tables which may be wheeled quickly into new positions. This does not mean that we have disregarded the advantages of the lift truck. On the contrary, we use this modern device to a large extent.

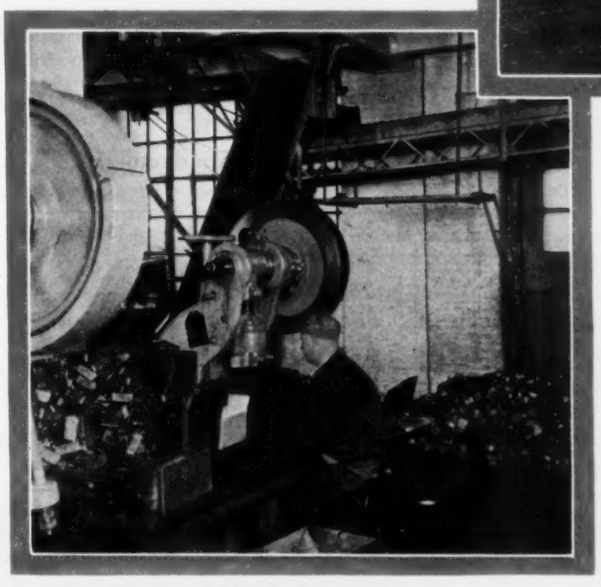
"Then too, we have been believers in the merit of so arranging machines in order of sequence of operations that the machine operator himself can pass the part to the next operator.

"In one instance we feel that we have kept particularly well abreast of improvement by designing a belt conveyor so that a single belt carries three sizes of outlet boxes from the press room and yet keeps them quite apart in transit and delivers them into separate bins in the cleaning room. This is accomplished by longitudinal steel separators supported just above the belt."

Like many other keen executives who have their ears to the ground, Mr. Appleton volunteered the opinion that our American mastery of production problems is not without its danger—the danger of production getting out of step with distribution. We have not progressed so far along the road to perfection in the handling of distribution problems as we have in production, and this means that there is ever present the temptation to overplay our production hand.

To change the figure of speech, "we must be ever watchful," says Mr. Appleton, "to see that we keep production in gear with sales. This, of course, doesn't mean that we should be content alone to hold production down to the distribution pace but, on the other hand, we must transfer, from time to time, a portion of our production effort to the intelligent engineering of distribution. The skill that has brought success in production will, with a proper transferring of emphasis, cause distribution problems also to yield."





AN interesting arrangement for handling lift truck tote boxes is shown in the view at the right. A hinged L-shaped piece with a small hoist tilts the box onto the packing table, thus permitting of considerable savings in the handling of materials. In the view below, and in the rear of the punch press, may be seen the three-track endless conveyor, a full description of which is given in the accompanying article

Electrical Manufacturers

BUY

- Ball, Roller and Sleeve Bearings
- Fractional Horsepower Motors
- Flexible and Rigid Couplings
- Belt, Rope and Chain Drives
- Switches and Fittings
- Motor Controllers
- Gears and Clutches
- Speed Reducers

WHILE the electrical manufacturer is a large buyer of materials of nearly all kinds he is not ordinarily looked upon as being an extensive user or purchaser of electric motors or of those materials and attachments usually associated with motors and motor drives. Quite to the contrary, however, a recent survey conducted by ELECTRICAL MANUFACTURING among its readers indicates conclusively that the manufacturers of electrically-operated machinery and appliances or devices do purchase motors and attachments for motors and motor drives in considerable quantities.

THE information given in the accompanying charts and tables was compiled from the answers to questionnaires received from electrical manufacturers, representing practically all the different branches of the industry. It is intended to show the average quantities of electric motors and materials or attachments usually associated with motors or motor drives these manufacturers buy

While this survey, which was in the form of questionnaires sent out to electrical manufacturers, was not intended to include all of the producers of electrically-operated machinery, it was sufficiently broad in its scope to take in those manufacturers representative of the various branches of the electrical manufacturing industry as a whole. Among those included, and from whom replies to the questionnaires were received, might be enumerated the manufacturers of laundry equipment, oil burners, phonographs, dental appliances, wrapping machinery, machine tools of many kinds and types, as well as the makers of other types of devices or apparatus that might be operated electrically.

Since the survey was so general in its scope no attempt has been made in collating the data obtained to set out with any degree of accuracy information relating to the various classes or groups of manufacturers using any certain size or kind of motors or attachments. But rather the various data have been arranged to indicate the average number of users in general of fractional horsepower motors and their attachments or equipment. Moreover, it was not the intention to point out exactly what percentage of the entire electrical manufacturing industry is represented by those replying to the questionnaires. It should also be understood in studying the dif-

FIGURE 1
Numbers and Types of Fractional Horsepower Motors Used by Electrical Manufacturers in Their Products

Types	Sizes of Fractional Horsepower Motors																	
	1/60	1/50	1/30	1/25	1/20	1/16	1/15	1/12	1/10	1/8	1/6	1/5	1/4	3/10	1/3	1/2	3/4	Total
Single phase, straight induction	1,000	0	10,601	5,000	2,025	62	3,000	50,000	41,350	1,040	108,154	0	168,777	0	44,247	6,779	4,104	446,139
Repulsion starting, induction running	0	0	6	0	0	0	0	0	0	562	39,036	0	54,467	0	6,090	8,400	12,424	120,985
Repulsion running	0	0	0	0	0	0	0	0	0	0	76,663	0	17,861	0	6,390	4,116	955	105,985
Series A.C.	0	0	0	0	0	0	0	0	0	153	180	75	7,290	0	0	1,100	154	8,952
Series D.C.	0	0	0	0	17	0	0	0	0	244	1,648	0	783	0	0	361	1,456	4,509
Miscellaneous types	0	5,000	500	17	2,020	197	1,025	165	2,560	38,470	18,770	262	4,062	2,000	188	66,882	3,652	145,770
Number of users of various sizes	1	1	5	1	10	6	4	11	9	22	43	2	116	1	20	73	43	358
Total motors used	1,000	5,000	11,107	5,017	4,062	259	4,025	50,165	43,910	40,469	244,451	337	253,240	2,000	56,915	87,638	22,745	832,348

This table was compiled from the answers to 358 questionnaires received from electrical manufacturers, and it shows that they purchase annually an average of 832,348 fractional horsepower motors of seventeen different sizes and five different classes or types. In the miscellaneous group are ten or twelve different kinds or types of motors that are considered more or less special

ferent figures and information set out in the accompanying tables and charts that they do not in all cases indicate true conditions with respect to the total number of replies to the questionnaires. In many cases the information supplied was either incomplete or was omitted from some of the questions asked, and in some few instances the questions did not all apply to the respective manufacturer to whom the questionnaires were sent, so that the figures and other data given here apply to the total numbers or average numbers answering the various questions in the questionnaire.

All of the information herein contained was compiled from a total of 358 questionnaires containing 32 questions each, and as has been stated the figures presented represent the answers to the various questions and not the questionnaires. It will therefore be seen that in many cases the totals set out in the accompanying tables and charts will not in all cases conform with the total number of 358. But, all of the information is based on the average consumption of motors and other motor attachments or equipment purchased by electrical manufacturers for a period of one year, and included in their products for resale.

In general it would appear from reference to Figure 1 that there are some 17 different sizes of fractional horsepower motors commonly used by electrical manufacturers in the course of a year's production of their various machines and devices. These range in size from 1/60 to ¾ horsepower, with motors as small as the former being but little used. It will be noticed that of a total of 358 users of fractional horsepower motors some 832,348 is the average yearly consumption, with those of ¼ horsepower being used by 116 manufacturers to the number of 253,240 annually. It would further seem from reference to Figure 1 that motors of small fractional horsepower are not employed extensively, as the greatest number of users appear to favor those from ⅛ horsepower up, with 73 using the ½ and 43 the ¾ horsepower. In the column headed miscellaneous it will be seen that these are used in all of the sizes indicated, except 1/60 horsepower, but this group includes many types of motors that are not otherwise listed or are considered more or less as special.

With respect to the different types of motors in most common use by electrical manufacturers it would seem that there are five with a preference being indicated for the single-phase straight induction type. In the miscellaneous group, which is not included above, are about ten or twelve various kinds or types of motors that are more or less of special make and not commonly used. In one year electrical manufacturers purchase 446,139 of these and 120,985 of the repulsion starting induction running type. Of the single-phase straight induction type there are 136 consumers and of the latter some 70 makers of electrical products employ them in their devices or appliances. Most of the other types are purchased in smaller quantities and by fewer users, although as a whole these latter are purchased in hundreds of thousands annually. This is clearly shown in Figure 2 from which it will be noticed that of the total of 358 only 23 use the repulsion running type, 27 the series A. C. type and 43 the series D. C. motor.

In considering the chart shown in Figure 3, with respect to different types of motor drives or connections through which power is applied, it should be understood that some of the manufac-

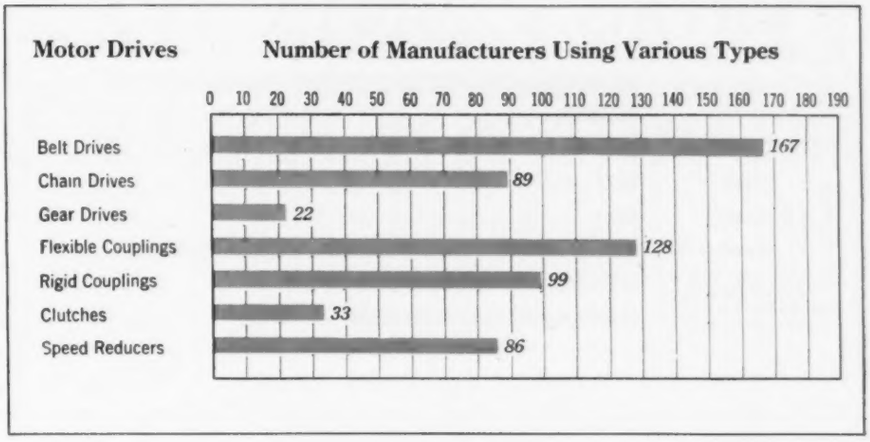


Figure 3

From the chart above it will be observed that belt drives are more extensively used by electrical manufacturers than any of the other types indicated. While many of them use chain drives, only a few drive their different products by means of gears. Flexible couplings are used by 128 and rigid couplings by 99, while many of them employ clutches and speed reducers on the various products they manufacture. It will be noticed that the total numbers shown in this table are greater than the total number of questionnaires because some use several types of drives

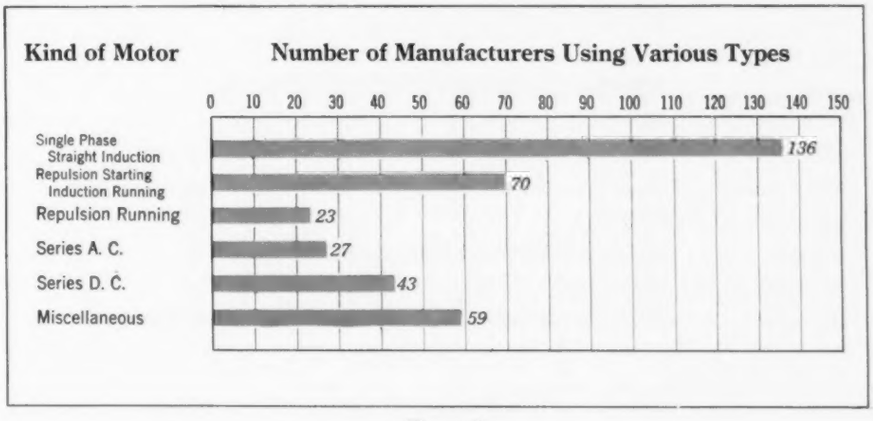


Figure 2

While the data in Figure 1 show the average number of fractional horsepower motors of the different kinds used by representative electrical manufacturers in the course of a year it does not include the number of users of the different makes of motors. This is shown above and it will be noticed that 136 report as using the single phase straight induction type, 70 the repulsion starting induction running, 23 the repulsion running, 27 the series A.C., and 43 the series D.C., while 59 manufacturers use motors of a more or less special make, classed as miscellaneous

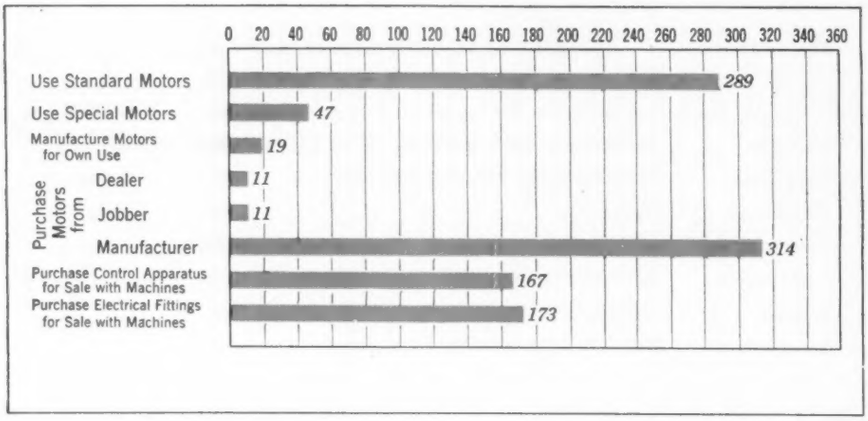


Figure 4

Practically all of the answers to the questionnaires from which the information in the table above was compiled indicate that most electrical manufacturers purchase electric motors directly from the manufacturer. Only a few of them use special motors, and out of the total of 358 *answers only* 19 *report as making their own motors. Most of these were manufacturers of motors as well as other electrical products. Control apparatus such as switches and controllers are purchased for resale with different devices and appliances by* 167, *while* 163 *buy electrical fittings for resale. In most instances these are for connections to the motors*

turers of electrically-driven machinery employ more than one type in the products they manufacture, which is the reason that the sum total of all the users of the various types of motor drives is greater than the total number of questionnaires. Evidently, from the figures set out in this chart, most of the electrical manufacturers employ belt drives on their products, although many of them use chain and gear drives, while still others derive power for their various machines and appliances through rigid and flexible couplings as well as speed reducers and clutches. Since the replies to many of the questionnaires were incomplete no attempt has been made in this chart to separate the different kinds and types of belt, gear and chain drives employed, since many of them employ silent chain, some texrope, others fiber gears and worm gears. Many of the replies indicated that some of the driving mechanisms were of original design and this applied particularly to those using speed reducers and clutches. On the other hand, those employing rigid couplings and gears state that this is the case for the reason that the motors are assembled as units directly on the various machines or devices they drive, thus making the use of these types of drives more convenient than others.

Figure 4 contains considerable information having to do with motors, electrical equipment such as switches, conduit, fittings and motor controllers. It will be noticed that 289 electrical manufacturers purchase all of the motors they use on their products, and that 314 of them buy directly from the manufacturer. Notice that the difference in these two totals is due to the fact that all asked did not reply to the first question. Only 11 each purchase motors either from dealers or jobbbers, but it was clearly evident in the answers to this question that many of those reporting indicated that they bought from the manufacturer while they really meant they bought from the manufacturer's agent, or the dealer.

It will also be noticed from this chart that only 47 electrical manufacturers report as using special motors, although many of them did state that in some instances they required special windings or some form of special mounting. Very few electrical manufacturers attempt to produce their own motors, as is indicated by the low report of 19 who do. In most of these cases electrical manufacturers only made motors when they were considered as one of the products of the company.

Since most electrical motors are purchased for attachment to some kind of machine or mechanical device it was considered expedient to learn what number of electrical manufacturers so constructed their products as to require the use of switches, controllers and electrical fittings. This information is to be found in the lower part of the chart in Figure 4, from which it will be seen that 167 report as purchasing control apparatus for resale with their products, while some 173 purchase electrical fittings, such as conduit, connections, and wire to be resold with the device to which it is attached.

(*Continued on page* 68)

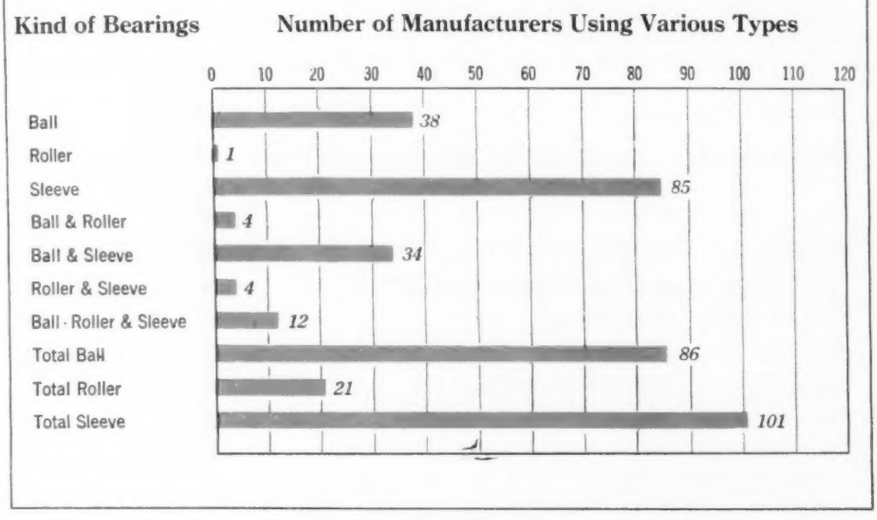


Figure 5

From reference to the chart above it would appear that electrical manufacturers using electric motors in their products prefer to have these motors equipped with sleeve or plain bearings. Only one reports as using roller bearings, while 38 *purchase motors equipped with ball bearings. Many manufacturers report as using several types of bearings in the different appliances, machines or devices to which the motors are attached, and several of them state that the choice of bearings is made by the purchaser of the different products they manufacture*

NEMA on Trade Practice and TARIFF Revision

The midwinter convention discusses business trends, frames a tariff brief and formulates a plan for manufacturers' support of local leagues

MODERN business trends, tariff revision, industry trade practice conferences and a common fund for the support of local electrical leagues were featured by the speakers at the general session of the mid-winter meeting of the National Electrical Manufacturers Association held at the Hotel Commodore and NEMA headquarters in New York the week of Jan. 21.

President Huntington B. Crouse, who made the address of welcome at the general session on Jan. 23, emphasized the hopeful aspect of many constructive trends in modern business and cited a recent series of bank advertisements as indicative of the spirit of cooperation. With respect to the present-day ability of industry to govern itself in accordance with an established code of ethics, through a medium such as that of the industry trade practice conference, Mr. Crouse declared that the time has arrived when this organization can govern its industry and formulate its plans in cooperation with the Federal Trade Commission.

The importance of the electrical leagues in industry market development, particularly in view of the proposed Electrical Industry Sales Conference Plan, was stressed by S. L. Nicholson in an analysis of the procedure for establishing a common fund for the support of the leagues. This coordinated plan of financing, which is an outcome of a study made by the League Council of league operating costs, has been approved by Nema and calls for the cooperation of national manufacturers of apparatus, material and supplies.

W. E. Sprackling, vice-president in charge of the supply division, urged the members present to give detailed attention to the question of industry trade practice conferences and stated that the association was ready to assist the individual sections or groups in the preparation of trade practice submittals.

A dinner meeting of section chairmen was held on Jan. 21. The mid-winter meeting concluded with a meeting of the board of governors on Jan. 25 at which approval was given to the Nema resolution requesting that an extra session of Congress be called as soon as practicable after March 4 for the purpose of general tariff revision.

The work that the tariff committee of Nema has been doing in Washington in connection with the preliminary hearings before the Ways and Means Committee of the House was outlined by Thomas Allen, chairman of that committee. Mr. Allen presented an abstract of a brief which has been submitted to the Ways and Means Committee and in which certain important revisions are requested by the electrical manufacturing industry.

In the words of the brief, Nema is not suggesting any increase in rates but merely a change in wording, which will clarify the law, so as to bring the classification of certain products under the rates which, it is believed, was the intention of Congress when the law was passed. Nema also recommends that in general the basis of valuation for the assessment of ad valorem duties should be changed from the foreign value, with its attendant difficulties of administration, to the American selling price of any similar competitive article manufactured and produced in the United States, where applicable. Where not applicable, it should be based on the domestic selling price of the foreign article in the United States.

The Tariff Brief

To the Ways and Means Committee:

The National Electrical Manufacturers Association, whose members manufacture products valued at approximately $1,500,000,000 per year and employ approximately 250,000 workers, is suggesting some slight changes in Paragraph 372. We are not suggesting any increases in rates, but merely a change in wording, which will clarify the Law, so as to bring the classification of certain products under the rates which, we believe, was the intention of Congress when the Law was passed.

Prior to the passage of the present Law, the majority of electrical products, when imported, were classified under the catch-all clause of the Metal Schedule, which is now Paragraph 399, with a duty of 40 per centum ad valorem.

Paragraph 399 specifically provides for certain articles containing electrical heating elements, as follows:

> "Table, household, kitchen and hospital utensils, and hollow or flat ware, not specially provided for, . . . composed wholly or in chief value of copper, brass, steel or other base metal, not specially provided for, 40 per centum ad valorem; and in addition thereto upon any of the foregoing articles containing electrical heating elements as constituent parts thereof, 10 per centum ad valorem."

When discussing the subject of other electrical devices with the Sub-Committee of the Ways and Means Committee in 1921, it was believed by said Sub-Committee that the provisions of Paragraph 399 were sufficient to cover all other electrical devices, not specially provided for, the rate of duty, 40 per centum, being considered adequate and satisfactory.

Some time after the passage of the Act, the United States Court of Customs Appeals handed down a decision (8 Ct. Cust. Appls. 273; T. D. 37,537), in which they academically defined a machine as being

> "a mechanical contrivance for utilizing, applying or modifying energy or force, or for the transmission of motion."

This very broad definition embraced many electrical devices and removed them from Paragraph 399 to Paragraph 372, as

> "all other machines or parts thereof, finished or unfinished, not specially provided for, 30 per centum ad valorem,"

although these articles are not commonly referred to as machines in commercial practice.

In the manufacture of an electrical article or device containing coils of wire for conducting the electrical current, which must be carefully wound and insulated, the labor cost is necessarily considerably greater than in an article which is commonly known as a machine, consisting of purely mechanical parts and not containing any electrical circuits.

We believe that the proper rate, and the rate intended by Congress for these electrical articles and devices, can be insured by the addition, in Paragraph 372, just before the clause "all other machines or parts thereof," of the following:

> "electrical machines, and apparatus, used in producing, utilizing, applying, controlling or modifying elec-

trical energy or force, not specially provided for, and parts thereof, if composed wholly or in chief value of metal, 40 per centum ad valorem."

This will remove the confusion which now exists as to which of these electrical products should or should not be classified as machines, relieving the customs officials, the appraisers and the Court of Appeals from troublesome protests and insuring importation of these products at the rate of duty which we believe was originally intended by Congress. No one will raise the question as to whether one of these electrical articles is or is not a machine, because the rate of duty would be the same, regardless of the result of the decision.

Steam Turbines

Many of the members of the National Electrical Manufacturers Association are also interested in steam turbines, not only on account of manufacturng them, but because they are chiefly used as parts of what are commonly called "turbo-generator sets." These sets are used to convert the energy of steam into the energy of the electric current and consist of a steam turbine driving an electric generator. Steam turbines themselves are not electrical devices and should properly be classified as machines. The Customs Court, Second Division, however, has ruled on July 14, 1927 (T. D. 42,315) that a steam turbine is a steam engine which, according to Paragraph 372, carries a duty of 15 per centum ad valorem.

In ordinary commercial language there is a very marked distinction between a steam engine and a steam turbine. In the steam engine the steam drives a piston back and forth in the cylinder, and this reciprocating motion is converted into rotary motion by means of the connecting rod and the crank. The cost of labor in the manufacture of such a machine is comparatively small.

In the steam turbine the steam impinges upon a large number of buckets around the periphery of a set of wheels. The necessity for extremely accurate dimensions in these buckets is such as to entail a very considerable cost of labor.

Reciprocating Engines

When the duty on steam engines was first specified at a lower rate than other machines in the Tariff Act of 1913 to the best of our knowledge steam turbines were not being imported, and we feel sure that it was not the intention of Congress to include them under steam engines. Within the past few years, however, a number of steam turbines have been imported, resulting in the ruling of the Courts, to which reference has just been made.

We suggest that the proper rate of duty, which was intended by Congress, will be made adaptable for steam turbines if the clause relating to steam engines be modified by inserting at its beginning the word "reciprocating." This clause will then read,

> "Reciprocating steam engines and steam locomotives, 15 per centum ad valorem."

There will be no ground for contending that a steam turbine is a reciprocating steam engine, and it will be classified, therefore, as a machine at 30 per centum ad valorem.

We believe it was the intention of Congress in writing the clause, "all other machines or parts thereof," etc., this being in the Metal Schedule, to mean the *metal* parts thereof. The Court, however, has interpreted this clause to mean any article, finished or unfinished, which eventually would become part of the machine (e.g., Ct. Cust. Appls. ———; T. D. 42,872).

This has wrought great injustice to many lines of manufacture, in placing articles formerly classified under different paragraphs of the Metal Schedule, such as woven wire-cloth, and also under difference Schedules, such as manufactures of wool, manufactures of porcelain, manufactures of glass, etc., under the Machinery Paragraph, 372.

We would, therefore, recommend that after the words "all other machines or parts thereof," in Paragraph 372, the following clause be inserted:

> "if composed wholly or in chief value of metal."

Those portions of Paragraph 372 covered by these recommendations, if modified, as suggested, will, therefore, read as follows, the words, which will be inserted, being italicized:

> *"Reciprocating* steam engines and steam locomotives, 15 per centum ad valorem . . . combined adding and typewriting machines, 30 per centum ad valorem; *electrical machines and apparatus, used in producing, utilizing, applying, controlling or modifying electrical energy or force, not specially provided for, and parts thereof, if composed wholly or in chief value of metal,* 40 *per centum ad valorem;* all other machines or parts thereof, *if composed wholly or in chief value of metal,* finished or unfinished, not specially provided for, 30 per centum ad valorem. . . ."

Nema's Recommendations

Our Association also recommends that in general the basis of valuation for the assessment of ad valorem duties should be changed from the foreign value, with its attendant difficulties of administration, to the American selling price of any similar competitive article manufactured or produced in the United States, where applicable. Where not applicable, it should be based on the domestic selling price of the foreign article in the United States.

We are opposed to any weakening of and in favor of the strengthening of the Anti-Dumping Provision of 1921, the Marking and Branding Provision of 1922 (Section 304) and the Retaliatory Provision of 1922 (Section 317).

National Electrical Manufacturers Association
By: Thomas F. Allen
Chairman, Tariff Committee.
January 14, 1929.

Plan Formulated for Support of Local Leagues

An orderly procedure for collecting and disbursing funds contributed by national manufacturers of electrical apparatus, material and supplies for the support of local electrical leagues, has been prepared by the committee on electrical leagues and approved by the board of governors of Nema.

Up to the present time there has been no satisfactory arrangement by which manufacturers have contributed to electrical leagues. Such contributions amount to about ten per cent of the combined league budgets. In the case of many small and medium sized manufacturers no contributions have been made because it was felt that too great a burden would be imposed by a worthwhile donation to each league. The correct amount to contribute to each respective league was another difficulty.

Under the Nema plan, national manufacturers will be asked to subscribe to a common fund for the support of local electrical leagues, said fund to be collected by a board of trustees nominated by the respective electrical manufacturers' trade associations and approved by the board of directors of The Society for Electrical Development. The amount contributed is to be based, insofar as possible, on a percentage of sales, to insure an equitable distribution of the manufacturers' proportion to the operating costs of the leagues. The funds thus collected will be allocated by the board of trustees, augmented by representatives of the S.E.D. and the league council.

A committee of eleven men appointed by the president of Nema will serve as Nema members on the board of trustees and will arrange for the cooperation of such national electrical manufacturers not now members of that association. The committee is composed of C. W. Abbott, D. R. Bullen, Marcus A. Curran, George E. Maguire, H. D. McKinney, S. L. Nicholson, H. C. Pond, R. J. Russell, A. L. Smith, A. E. Tregenza, E. A. Williford.

Armored Cable Industry Rises to Prominent Position

In a recent announcement, A. Penn Denton, engineering director of the armored conductor and flexible metallic conduit section of the National Electrical Manufacturers Association, states that the section, as a manufacturing group, recognizes the broad field of use for armored conductors in residential, industrial, commercial and farm wiring. With this in mind, it has engaged in a trade extension program which contemplates constant research and development in conduit and fittings.

The armored cable industry has grown from an infant industry twenty-five years ago to its present prominent position as a leader in the manufacturing wiring field. Through cooperative effort, it expects to extend the use of armored conductors in all wiring fields. The section believes that the trend in wiring practice today, as given in the National Electrical Code, is toward standardization in all types of wiring.

SECTION Council a *Feature of Nema's* Reorganization

The regrouping of sections as outlined in the new constitution and by-laws, will develop a more effective degree of cooperation

THE revised constitution and by-laws just passed by the National Electrical Manufacturers Association mark a new departure in association management.

The outstanding feature of the constitutional revision, which is the creation of a council of the chairmen of all groups in Nema, creates a federation of electrical manufacturing industries. Member companies making similar products are combined in approximately fifty such industry groups or sections. Larger groups are effected by combining sections with mutual interests and problems into divisions of which there are now five in Nema.

In the new section council the leaders of the individual groups, both sections and divisions, will be able to accelerate and render their efforts more efficient through the closer relationship with the board of governors to which they will annually elect nine of their number. Immediately after each annual meeting, the governors will select thirteen of their number as members of the executive committee, of which eight will be selected from the elected members of the board and five from the members of the board selected by the section council.

In view of the fact that all association activities originate in the groups, which are now represented on the governing body, an astonishing degree of mobility has been obtained. Association growth usually spells unwieldiness. In the case of Nema, however, where the rate of growth during the two and one-half years of the association's existence has been exceedingly rapid, careful management has overcome this danger and endowed increased stature with greater flexibility.

The revised constitutional set-up also provides for the re-grouping of sections into new divisions in which, it is believed, a closer and more effective degree of cooperation can be obtained by the individual sections thus organized. A new divisional grouping has been suggested and is at present being considered by the sections.

The old divisions are a holdover from the original separate and distinct organizations and were once recognized as the only practical means of bringing the separate organizations together. In many cases this grouping did not represent the most logical arrangement of sections, which are really the basic units of the association and the point of greatest activity and interest for the members. Outside of the section activities, the policies division, composed of the chief executives of all member companies, is the policy-determining group for the association and will be retained.

Some of the suggested groups of sections for new divisions of Nema are as follows:

Appliance, industrial heating, insulating material, lighting, radio, roughing-in materials, transmission and primary distribution, utilization and control, wire and cable, and wiring devices. Approval of this or some similar re-grouping will probably be given at the time of the spring meeting and become effective at that time.

By decreasing the number of meetings from six to three each year, the association believes that approximately $300,000 will be saved annually to the membership. This figure is estimated on the basis of the saving in time, traveling and other expenses to the membership because of the smaller number of meetings. The annual meeting of Nema will be held in the Fall instead of the Spring, as heretofore, at such time and place as the board shall determine. In addition, two other meetings of the association may be held each year. Each section will also have at least two meetings each year, coinciding with the annual meeting in one instance.

Summary of the Major Changes in the New Constitution

The following summary gives the major changes which are now effective in the revised constitution and by-laws of Nema:

1. The board of governors shall be composed of thirty members instead of being composed of the divisional vice-presidents and twenty-seven members.
2. The executive committee shall be composed of the president and treasurer and thirteen members of the board, eight of which shall be selected from the elected members of the board and five from the members of the board selected by the section council. (See Paragraph 4.)
3. The divisions, as now constituted, are eliminated with the exception of the policies division, and instead, such aggregations of sections having a common interest and being a representative branch of the industry may be organized into divisions by the board of governors. (No change is contemplated in the radio and appliance divisions as now constituted. Such re-grouping as the sections in other divisions may desire is provided for by this change.)
4. For the purpose of coordinating and promoting recommendations of the board regarding section activities, a section council shall be organized, composed of all division and section chairmen of which the president shall be chairman.
5. The annual meeting of the association shall be held during the month of September or October, instead of May or June, as at present.
6. At least two meetings of the policies division shall be held each year, one at the time of the annual meeting of the association and one in the Spring.
7. At least two meetings of each section shall be held each year, one at the time of the annual meeting and one at the call of the chairman.
8. The section council shall hold a meeting at the time of the annual meeting, one in mid-Winter and one in the Spring, preferably coordinated with the meeting of the board of governors.
9. At each annual meeting of the association, seven governors shall be elected by the policies division for a term of three years, and at each annual meeting, following the election of the division and section chairmen, the section council shall elect nine of its number as members of the board of governors for the term of one year.
10. After each annual meeting, the board of governors shall elect from among its members not more than five vice-presidents, who shall hold office for one year.

Porcelain Insulation — Its Uses in the Electrical Industry

No. 10 of a Series of Articles on Common Materials

These are typical examples of some of the more common types of high voltage insulators manufactured by the wet process

While electrical porcelain is made by pottery methods it is a distinct and very highly specialized branch of the ceramic industry, so much so that electrical porcelain manufacturers have a keen understanding of the electrical duties which their products are called upon to perform

By William Crawford Hirsch

PORCELAIN is one of the electrical industry's oldest insulating materials. Amid the keenest of keen competition from compositions of later origin, it has more than held its own, chiefly so because of steady advancement in production methods by which quality standards were raised without costs being enhanced. The evolution of a porcelain insulator from the raw clay mixture to the finished product involves a score or more operations, and when it is considered that heat is the principal medium with which the electrical porcelain manufacturer reduces his plastic raw materials to the accurate dimensions called for in insulating parts, one can not help but marvel at the almost infinitesimal tolerances that have become customary.

¶ A knowledge of the principal characteristics of raw materials and parts is the essential basis of a rational production policy. Electrical porcelain, one of the oldest insulating materials in the electrical industry, has gained ground in spite of the keenest competition of competitive materials, and if the electrical manufacturer would choose his materials wisely he must keep abreast of the constant developments that affect their quality

The principal raw materials used in the manufacture of electrical porcelain are clay, feldspar and flint. The proportion and properties of each of these minerals have a direct bearing on the dielectric strength of the finished insulator. Dielectric strength is greatly influenced by the density of the clay mass or vitrification area. An excessive proportion of clay in the mix, however, would impair mechanical strength and color. Roughly speaking, electrical porcelain batches consist of 50 per cent clay, 30 per cent feldspar and 20 per cent flint. Small quantities of magnesia may be introduced as a toughener for bodies and glazes, replacing a corresponding part of feldspar. In porcelains called upon to offer a high degree of heat resistance, such as in connection with cooking and heating appliances, talc or steatite, possessing low shrinkage and coefficient of expansion and able to withstand sudden and frequent temperature changes, find employment. A number of rarer earths, such as andalusite, cyanite, dumortierite, mullite, etc., are at the electrical porcelain manufacturer's disposal when he has to meet out-of-the-ordinary conditions. No matter what materials are used, the greatest care is taken to keep out iron. Scales with set and locked beams for each ingredient are used to insure uniformity of mix and strict compliance with formulas which are regarded more or less as manufacturing secrets.

Low voltage insulators, fittings such as knobs, cleats, bases for knife-switches and cut-outs, bodies for receptacles, plugs, sockets and snap and push switches are made by what is known as the dry process, while high voltage insulators are made by the wet or fluid casting process.

The initial preparation of the raw material is the same for both the dry and wet processes. It is either prepared in blungers, large mixing machines that insure the disintegration of the minerals by the addition of water and the agitating mechanism into what is known as the "slip," or a pebble mill is used to accomplish this. The latter has the advantage of permitting closer control of grain-size, but necessitates the subsequent use of a magnetic separator to make certain that no iron has found its way into the mass. The slip is cleansed of all foreign matter through screening and then pumped to a filter press where part of the water content is eliminated and cakes of uniform size and of dough-like consistency formed. In some plants these cakes are subjected to an aging process of several days to improve the homogeneity of the mass.

For the dry process the cakes are dried and then reduced to powder form in a beater or pulverizing mill. In this shape the ground clay goes to the presses which hold

*Photographs by courtesy Imperial Porcelain Works and The Star Porcelain Company of Trenton, N. J.

the steel dies that shape the insulators. The diemaker is perhaps the most important among the many artisans who contribute their skill to the making of electrical porcelain. The shrinkage of porcelain in the firing process is approximately 12½ per cent, but shrinkage in drying before the ware goes to the kiln must also be taken into consideration. It is, therefore, nothing short of astonishing how accurately an expert die-designer computes the allowance he must make for shrinkage, especially so in intricate shapes with recesses that must be just large enough to hold securely in place the smallest of metal inserts. It is nothing unusual for a manufacturer to guarantee that measurements will vary less than the one-hundredth part of an inch from the specifications,—a tolerance limit that may not be astonishing in the working of metals with precision tools, but certainly a most impressive achievement when reduction depends to a large extent upon atmospheric influences.

Dies for small insulator parts are usually of the multiple type, as many as six of the same shape being formed by one die. The die is inserted in the press, the operator filling it with the ground clay, a task that calls for considerable skill because in insulators with both thin and thick walls success depends to a marked degree upon the operator packing the clay tighter into one part of the die than another. In applying pressure, the operator must work with a nice regard for uniformity of the handpower applied, else the porcelain will not run even in size. As fast as the shapes are pressed, the operator lines them up on a tray, sufficient density having been attained to permit of the ware being handled. This so-called "dust-pressing" method of production entails considerable economies over the wet process, chiefly because one die permits of quantity production, whereas in the fluid casting processes a large number of molds are necessary.

¶ The electrical manufacturer who understands the methods by which his raw materials are produced is frequently able to make valuable suggestions in placing his orders for materials or manufactured parts

Before outlining the salient features of the wet process and the operations that follow the forming of "green" ware, the name by which porcelain is known before it has been fired, it should be stated that the electrical porcelain industry has two divisions, the manufacture of standard shapes, such as wiring fittings of the cleat and knob type, and of special shapes made according to buyers' designs and specifications. Quantity production, of course, is in the field of standard shapes. With one exception, all of these are made by the dry process. Tubes are made by the wet process, the clay, as it comes from the filter press, being forced through steel dies from which it comes forth in hollow cylinder form. Humidity drying imparts to these so-called "rolls" the required plasticity. They are then headed and ready for further drying and firing, both of which processes are no different from the procedure used in the dry process.

¶ Standard porcelain for wiring fittings, such as knobs, cleats, and many other parts are made by the dry dust process. While this permits of quantity production, manufacturers maintain the closest control and every single piece undergoes the most careful inspection before it is shipped. With porcelain manufacturers taking every possible precaution to ship nothing but perfect products consumers may well accept this as the settled policy of the industry to deliver only the best it is capable of producing

In the manufacture of high voltage insulators, a variation of the wet process, referred to by ceramists as the stiff mud process, is usually employed. Plaster-of-Paris molds take the place of dies. The slip is poured into these, and although many short-cuts and mechanical refinements have been developed in the last few years, the forming operations in the stiff mud process embrace all of the potter's deft touches and feats on a lathe.

Mechanical dryers await the porcelain after it has been formed, no matter by what process. Standard type insulators are dried at about 150 deg. Fahr. In modern plants, the formed ware is automatically conveyed to the dryers and from these to the dipping room. In some plants, the ware is also water-smoked to eliminate chemically contained water.

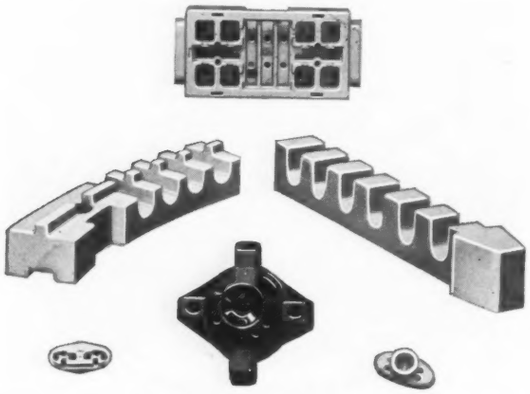
Notice the intricate design of the heating unit brick for an electrical stove made of porous refractory heat resistance material

In the dipping room, expert operators "fettle" the porcelain, removing all rough edges, burrs, slivers, specks, etc., with wooden sticks, brushes, and other implements. Glazes are applied by a spraying machine or by dipping, the glaze substance being compounded of the same raw materials as the body, but in proportions that result in a glass surface. Special attention is paid to the perfect fit of glaze and body in point of thermal expansion, lest shivering or crazing, resulting from a difference in the coefficient of expansion of body and glaze, set in. In the case of high voltage insulators, made by the stiff mud process, the glaze is usually black or dark brown, and great care is taken to prevent it from turning conductor as the result of improper firing, an increase in temperature beyond a certain point having the tendency of changing porcelain from an insulator to a conductor.

Containers, known as "saggers," are used to protect the porcelain during the firing process. These crucibles, which are made on special presses from a batch containing considerable grog or ground fire clay, are properly dried and inasmuch as the length of their service is one of the important cost items in electrical porcelain manufacture, much attention is given to their composition and production. With good care they may withstand kiln heat and handling six or more times. When they crack, the fragments are ground and used in the mixture for new saggers. The ware is

carefully placed in these saggers, and just as much care is taken to place the filled saggers in the kilns so that the fullest possible use of kiln capacity is made.

Among the many different types of kilns used in the firing of electrical porcelain, the so-called tunnel kiln has attracted most attention of late. The General Electric Co. pioneered in the installation of this type kiln about 15 years ago. Electrical porcelain manufacturers are constantly striving to reduce fuel costs, and for that reason they frequently do not shun the high initial cost of installing new type kilns. Electrical porcelain is fired at very high temperatures, ranging from 2462 to 2642 deg. Fahr., and the



Highly complicated designs of low voltage insulators made by what is termed in the industry as the dry manufacturing process

fuel bill is one of the most important items among costs. For some time there was a tendency to substitute oil for coal and producer gas, but lately coal seems to be regaining favor as the most economical fuel.

Dry process porcelain consumes as a rule on an average of 30 hours in the kiln. Vitrification of the glaze takes place at the same time as the burning of the body. When the kiln has cooled sufficiently, the finished ware is "drawn" from it and subjected to a final inspection preparatory to packing. Material that is imperfect is rejected, and steel gages are used to make certain that special shapes with interstices for the imbedding of metal parts come up to the required specifications.

Comprehensive specifications for high voltage porcelain have been worked out by the American Society for Testing Materials, taking into consideration: compressive strength, resistance to impact, dielectric strength, resistance to thermal change, moisture absorption, etc. The National Electrical Safety Code provides that "insulators for operation on supply lines of voltages exceeding 7500 volts shall be of porcelain or other material which will give equally good results in respect to mechanical and electrical performance and durability, and should be marked by the maker with a classification number and maker's name or trade-mark, the marks being so applied as not to reduce the electrical or mechanical strength of the insulator." The Code also makes mention of "thoroughly vitrified and glazed porcelain" as a suitable insulator support for storage batteries and for terminal bases on motors and generators. Toughness and elasticity are among the most important requisites of high voltage porcelain insulators, so as to fit them for resistance to the effect of high frequency. Mechanical strength is also highly important as a protection of cores should a missile hit the insulator. Density of structure, so as to preclude the absorption of moisture, is, however, one of the most important properties in both high and low voltage porcelain insulators. In this connection, it should be stated that some electrical porcelain insulators are used unglazed.

Dies for special shapes of porcelain insulators are paid for by the buyer whose property they remain. The manufacturer assumes the care of the special dies, and quite frequently replaces them at his own expense when they are worn out following commensurate production.

Aside from its use in wiring fittings, bushings in transformers, wall and floor tubes, potheads, etc., porcelain finds employment in the electrical industry in connection with electric signs and in some types of lighting fixtures. In these uses, however, the porcelain is not what is generally understood by electrical porcelain which designation is restricted to material specially made for insulating purposes.

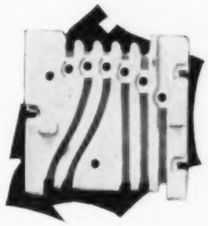
¶ When electrical manufacturers specify less liberal tolerances on insulating parts than are required by the use for which the insulators are intended they merely increase the production or manufacturing costs

In as much as porcelain insulators are used for such a diversified number of applications, and as the particular use of the insulator often governs the method of its production, it is highly essential that the porcelain manufacturer have as much data and information about the application of the insulator as it is possible for the user to give him. In the long run it will be found that when this practice is followed both the porcelain manufacturer and the user will be greatly benefited. This is due to the fact that insulators are made, usually by two processes, and from many different kinds of materials, all of which require different methods of handling and treatment in the course of production. Therefore, without a full knowledge of the application of the insulator the manufacturer is at a loss to know just what materials to use or what treatment the semi-finished product should undergo.

¶ When the porcelain manufacturer knows what an insulator of special design is to be used for and under what conditions, he can go about intelligently to embody the desired properties in as high a degree as possible in the finished product. Without such information it may readily be seen that he is laboring under a serious handicap which the consumer could well overcome by sending full data and complete information with orders

Then too, quite frequently users of porcelain insulators often require extremes in accuracy by the manufacturer when greater tolerances would serve just as well. In other words, every user of porcelain insulators should be careful to study the applications of the insulators fully before he makes drawings and prepare specifications for them. When it is understood that the shrinkage of porcelain in the firing process is often as much as 12½ per cent it can be readily seen that extreme accuracy is required in the making of the dies for the insulators to insure that the finished product will fulfill requirements. In this respect, when there is the least doubt in the mind of the user of insulators it would be well for him to consult with the manufacturer before any drawings or specifications are prepared. It has been found, because of his intimate knowledge of porcelain production, that the manufacturer can often assist the user in planning the insulator so as to save both time and money in its production, all to the end that both will be benefited materially when they cooperate with each other fully.

ELECTRICAL PORCELAIN and its EVOLUTION

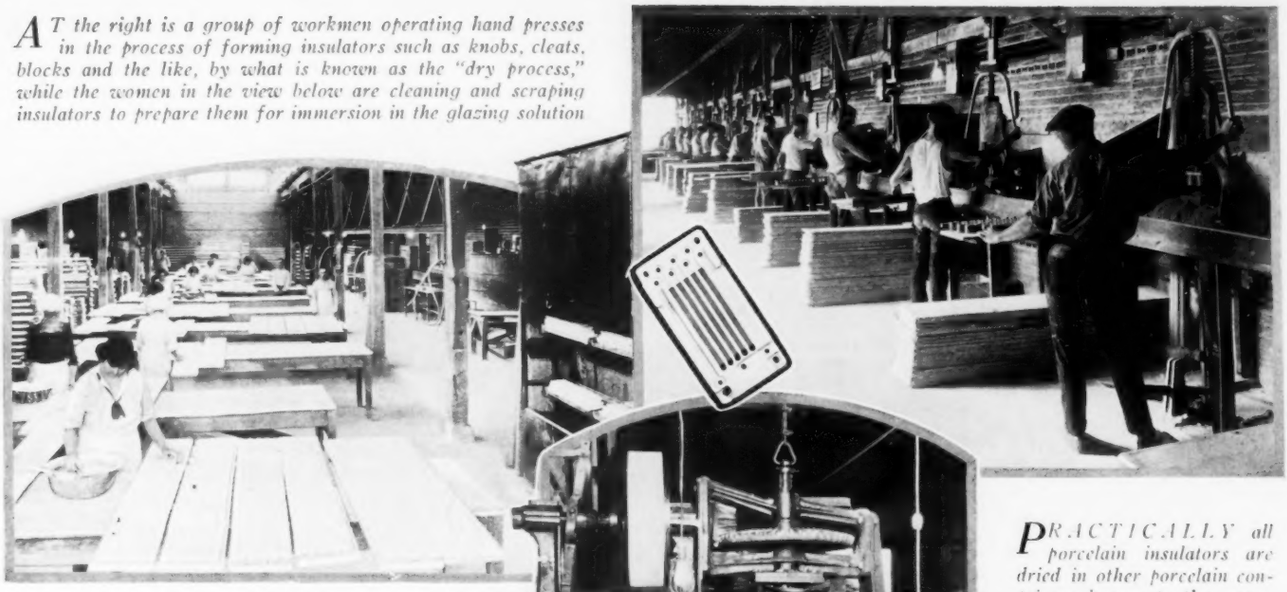


The manufacture of electrical porcelain is a highly important branch of the electrical industry because of the many intricate processes involved and the extreme accuracy required in the production of most of the more complicated pieces

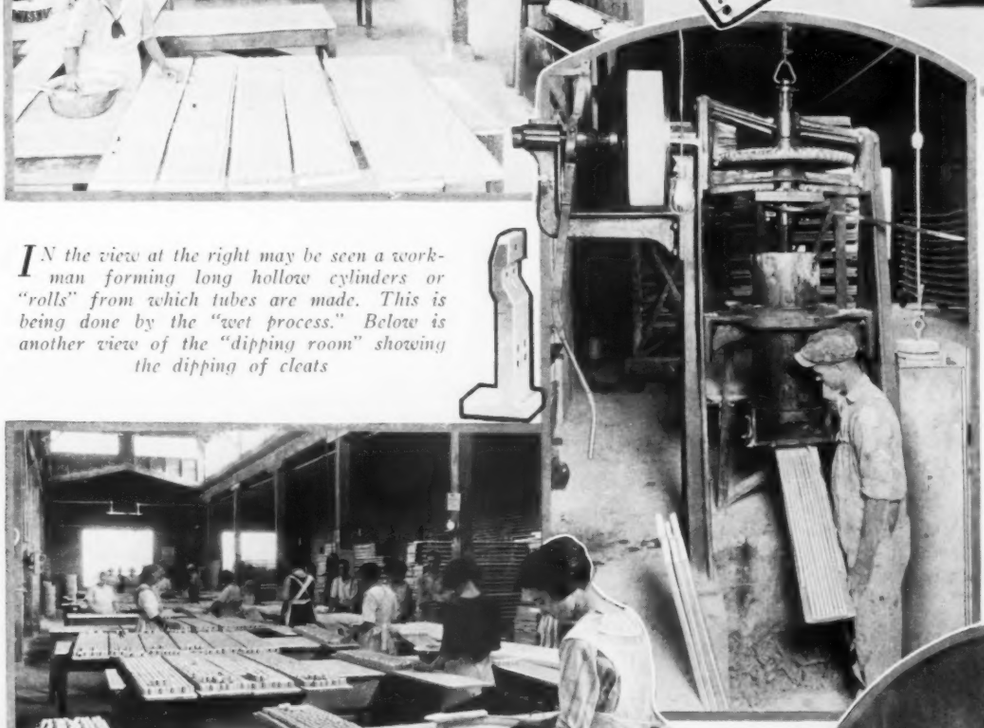
THE illustrations on this and the two following pages, together with the article on the three preceding pages describe the many intricate processes involved in the production of electrical porcelain insulators. The photographs reproduced herewith, through the courtesy of the Star Porcelain Company of Trenton, N. J., show how several types of insulators are manufactured in one large plant

AT the lower left may be seen a rack of porcelain insulators as they are being removed from a drier. In the illustration in the center two operators are sorting tubes for the "heading" operation, while the illustration below shows the manner of loading or "placing" a kiln. In this operation the insulators are packed in "saggers" or containers and these are piled one upon the other in the kiln

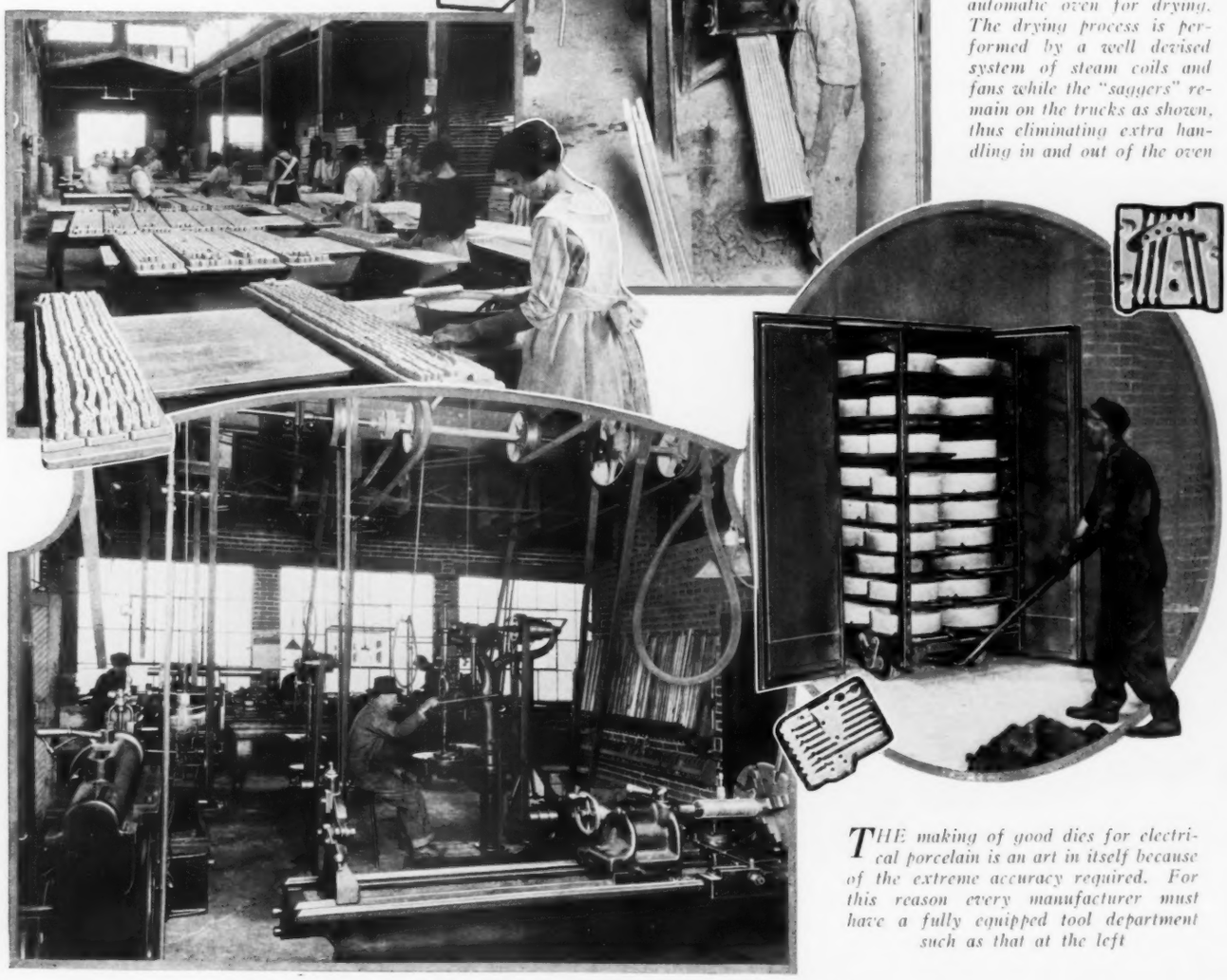
AT the right is a group of workmen operating hand presses in the process of forming insulators such as knobs, cleats, blocks and the like, by what is known as the "dry process," while the women in the view below are cleaning and scraping insulators to prepare them for immersion in the glazing solution



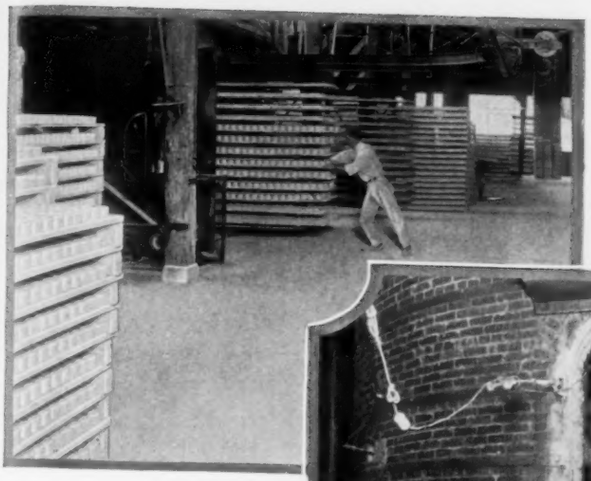
IN the view at the right may be seen a workman forming long hollow cylinders or "rolls" from which tubes are made. This is being done by the "wet process." Below is another view of the "dipping room" showing the dipping of cleats



PRACTICALLY all porcelain insulators are dried in other porcelain containers known to the manufacturer as "saggers." These are made much in the same manner as the insulators and they undergo the same treatment with respect to drying. In the illustration below is a truck load of "saggers" as they are being placed in an automatic oven for drying. The drying process is performed by a well devised system of steam coils and fans while the "saggers" remain on the trucks as shown, thus eliminating extra handling in and out of the oven



THE making of good dies for electrical porcelain is an art in itself because of the extreme accuracy required. For this reason every manufacturer must have a fully equipped tool department such as that at the left



AFTER being formed the insulators are dried in an automatic oven heated to about 150 degrees. Racks suspended from an overhead I-beam rail system convey the "green" ware from the forming presses into and through the drying ovens. This operation is illustrated in the view at the left. The man in the view below at the right is shown operating an improvised crushing device in which filter press cakes of clay are broken into small pieces, after which the material is moistened and reduced to a very fine powder in devices known as grinders or beater mills, which leave it in the form of damp dust

DURING the firing of the kiln the "green" ware in the "saggers" is converted into the finished product and as soon as the kiln has cooled sufficiently to permit of entry it is unloaded or "drawn" as is shown in the view at the right. The workman with the shovel in the illustration below at the right is mixing the ingredients from which porcelain is made. This operation requires considerable accuracy to insure that only the exact amounts of the several different materials employed is compounded in the mixing operation

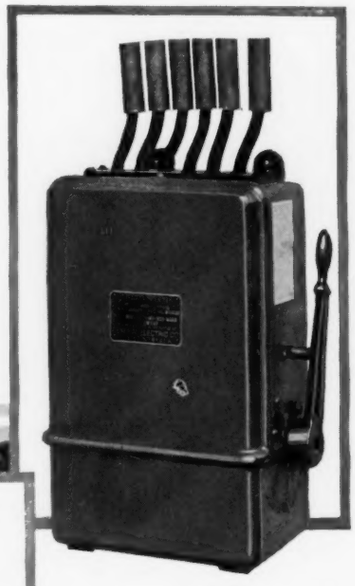
THE equipment shown in the view above is used for making "saggers" in which electrical porcelain is dried. In both the wet and dry processes the materials used in electrical porcelain pass through devices known as filter presses like those shown at the right

Compensator Design Advances with Industry

Compensators originated in 1898. *A wall-type appeared in* 1901, *and an improved type was manufactured in* 1902. *In* 1909 *a different compensator was introduced. The* 1898 *type was redesigned in* 1917 *and used until* 1924. *Overload relays are employed today*

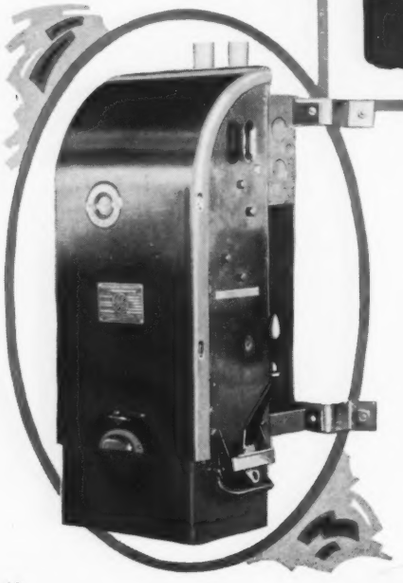
ABOVE is a view of the original hand-starting compensator, consisting of a cast iron box, auto-transformer and knife switch, mounted on the same base with the transformer

At the right is shown the 1902 *design, with rugged switch and overload protection. The blade type of switch was changed to the drum switch blade with improved cylinder*



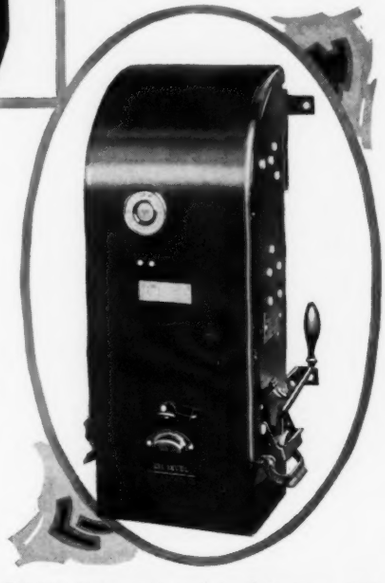
ABOVE is a view of the wall-type compensator of 1901. *This type had a cylinder switch, with knife switch contacts immersed in oil.*

The type of 1909, *at the left, featured undervoltage and overload protection by fuses or dash pot overload relays*



AT the left is shown the design of compensator used in 1917, *a complete redesign of the* 1898 *hand starter. This type of self-contained compensator, with overload and undervoltage features mounted inside the case, arranged so the compensator could be wired in the circuit*

At the right is the design of the compensator in use today. The use of thermal overload relays in place of dash pots is the important innovation. Multiple rated auto-transformer coils and improved push-button mechanism, including attachment to reset thermal overload relay, are new features



Photos by Courtesy of General Electric Co

GAIR

CASES

GAIR CORRUGATED SHIPPING CASES
Electrical apparatus is constructed with exactness, of material that is sensitive, fragile and easily dislocated by vibratory shock. Gair Corrugated Cases are built for the safe transportation of many products, but the essence of quality and precision in structure looms large in our service to electrical manufacturers.

ROBERT GAIR COMPANY
420 LEXINGTON AVENUE, NEW YORK CITY

RIBOHM

Ribohm is the trade name of a patented resistive element made only by Ward Leonard Electric Co. It is made of a special alloy metal, formed into a "U" shaped channel for structural strength.

Ribohm has a practically zero temperature coefficient of resistivity, and does not suffer from "fatigue" under vibration. A uniform cross section gives uniform temperature rise under load over the entire resistive element, and entirely eliminates "current crowding."

Weight for weight, Ribohm dissipates more energy than any other resistor. It is light, rigid, strong, and simple in construction and flexible in use. Ribohm, in many applications, eliminates all internal wiring in the resistor or rheostat, with resultant economy of assembly.

What Are The Applications of RIBOHM?

RIBOHM is a heavy duty resistor manufactured only by the Ward Leonard Electric Co. It was developed seven years ago and has been placed in actual service for test in all of the major fields of application for large current capacity resistors.

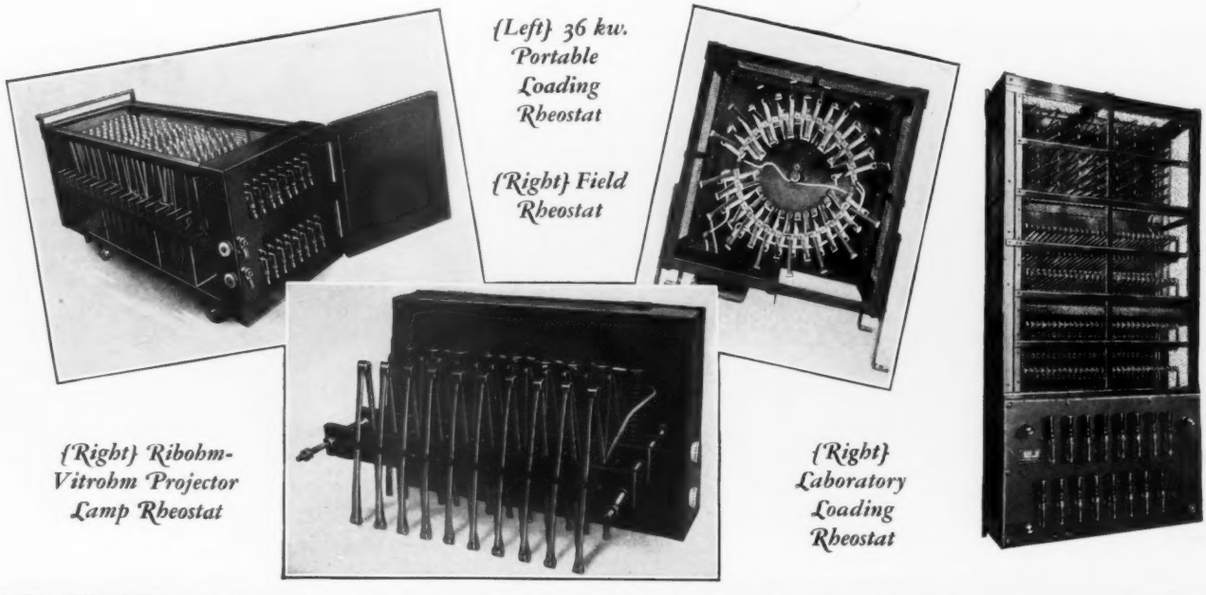
Ribohm includes among its advantages for this work a low temperature coefficient of resistivity, the lightest weight of any resistive element having an equivalent rating, a marked simplicity in application and use, and extraordinary mechanical strength in its ability to withstand mechanical shock, and excessive vibration.

Ribohm is used extensively for . . BATTERY CHARGING PANELS . . FIELD RHEOSTATS . . HEAVY DUTY MOTOR STARTERS AND CONTROLLERS . . ELECTRIC FURNACE RHEOSTATS . . ELECTRO-PLATING TANK RHEOSTATS . . LABORATORY AND PORTABLE LOADING RHEOSTATS . . PROJECTION AND ARC LAMP RHEOSTATS . . LARGE CAPACITY AIR HEATERS . .

In short, Ribohm is rapidly becoming the standard resistive element for use where service is difficult and the elimination of the usual resistor trouble is desired.

If you employ heavy duty resistors in your control, Ribohm is of interest to you. Our engineering department will work with yours in a preliminary determination of your resistor problems. This service will not obligate you in any way.

WARD LEONARD ELECTRIC CO.
MOUNT VERNON, NEW YORK



{Left} 36 kw. Portable Loading Rheostat

{Right} Field Rheostat

{Right} Ribohm-Vitrohm Projector Lamp Rheostat

{Right} Laboratory Loading Rheostat

Utilizing *Aviation* for *Radio Research*

ABOVE is shown the five-passenger plane of the Pilot Elec. Mfg. Co., Brooklyn, N. Y., known as the Pilot Airplane Radio Laboratory, fueling in preparation for a trip to Washington, where experiments on a new visual radio beacon were conducted in cooperation with the United States Bureau of Standards. At the right is an example of publicity accruing to the owners of the plane incidental to their experimental work

LABORATORY PLANE MAKES FLIGHT RECORD

What is believed to be record time for a plane of its size was recently set by the flying laboratory of the Pilot Manufacturing Company in a fast flight from Washington to New York.

The plane took off from Bolling Field, and with a tail wind arrived at Curtis Field one hour and fifty minutes later, averaging a speed of approximately 125 miles an hour. The plane was piloted by Louis Meier, naval reserve officer, while Zeh Bouck, radio engineer, and A. K. Hunman, of the Bureau of Standards, were passengers.

At Washington, left to right: Mr. Dunmore, director of radio research, U. S. Bureau of Standards; Harry Diamond, bureau engineer; Louis Meier, pilot of the airplane laboratory; Zeh Bouck, author of this story, and Mr. Hunman, bureau engineer. Bureau engineers are holding radio beacon apparatus

Three uses are made of the Pilot airplane radio laboratory: experimental work on airplane radio equipment, quick contact with customers, and publicity. Important operating costs have been obtained.

By Zeh Bouck

Engineer in Charge of Aeronautics Pilot Elec. Mfg. Co., Brooklyn, N. Y.

IN June, 1928, the Pilot Electric Mfg. Co. purchased a five-place Stinson-Detroiter to be used mainly as a radio laboratory to investigate the various problems arising in connection with the use of radio for airplanes. Besides this, the plane has been used for quick transportation and for general publicity purposes. The comments that follow intend to describe the brief history of this one plane, and to speculate somewhat as to the general practicability of airplanes for electrical manufacturers.

As was said, the principal purpose for which the Pilot plane was purchased was for a radio laboratory. It is hoped ultimately to make developments in radio receiving and transmitting equipment that will contribute

CURTISS FIELD, at Mineola, Long Island, the airway terminal of New York City. The Pilot plane is kept in one of the hangars in the foreground. This airport is only eight hours from Chicago and two hours flying time from Washington

considerably to the safety of trans-oceanic flights. In the course of the development work that has already been made, the plane was recently taken to Washington where tests were conducted jointly with the United States Bureau of Standards on their radio beacon. The radio beacon is, in the last analysis, a small instrument plugged into the instrument board before the pilot which gives him a visual indication of whether or not he is on his course. This device is sensitive over a distance of 200 miles.

There is no direct profit in this development work, but it is hoped that eventually something really genuine to the art of flying will be contributed, which may, incidentally, bring a profit to the company. Already considerable development work has been done, and a fairly satisfactory line of transmitters and receivers has been evolved.

The second use of the plane is for quick transportation. For instance, last June it was used to make an eight hour flight to Chicago, saving one whole working day in New York. Numerous flights to Boston have had their commercial significance, and on various occasions where speed has been absolutely essential, radio parts have been delivered by air.

The third utility of the plane is its publicity value. This, in the majority of instances, is incidental, and accrues as a natural result of experimental work. For instance, the recent return trip from Washington set a record for this size of ship, and resulted in valuable publicity indicated by the news clipping reproduced on the preceding page.

When the Graf Zeppelin visited this country, the Pilot plane broadcast a description of the event from the air over radio station WOR. The plane carried a radio announcer and a short wave equipment for broadcasting to the land station in New Jersey. This was put on the wires and rebroadcast over WOR's regular channel to the world in general. Naturally considerable publicity resulted from this feature, as well as from the short announcements that were made frequently over WOR for several days prior to the arrival of the Zep.

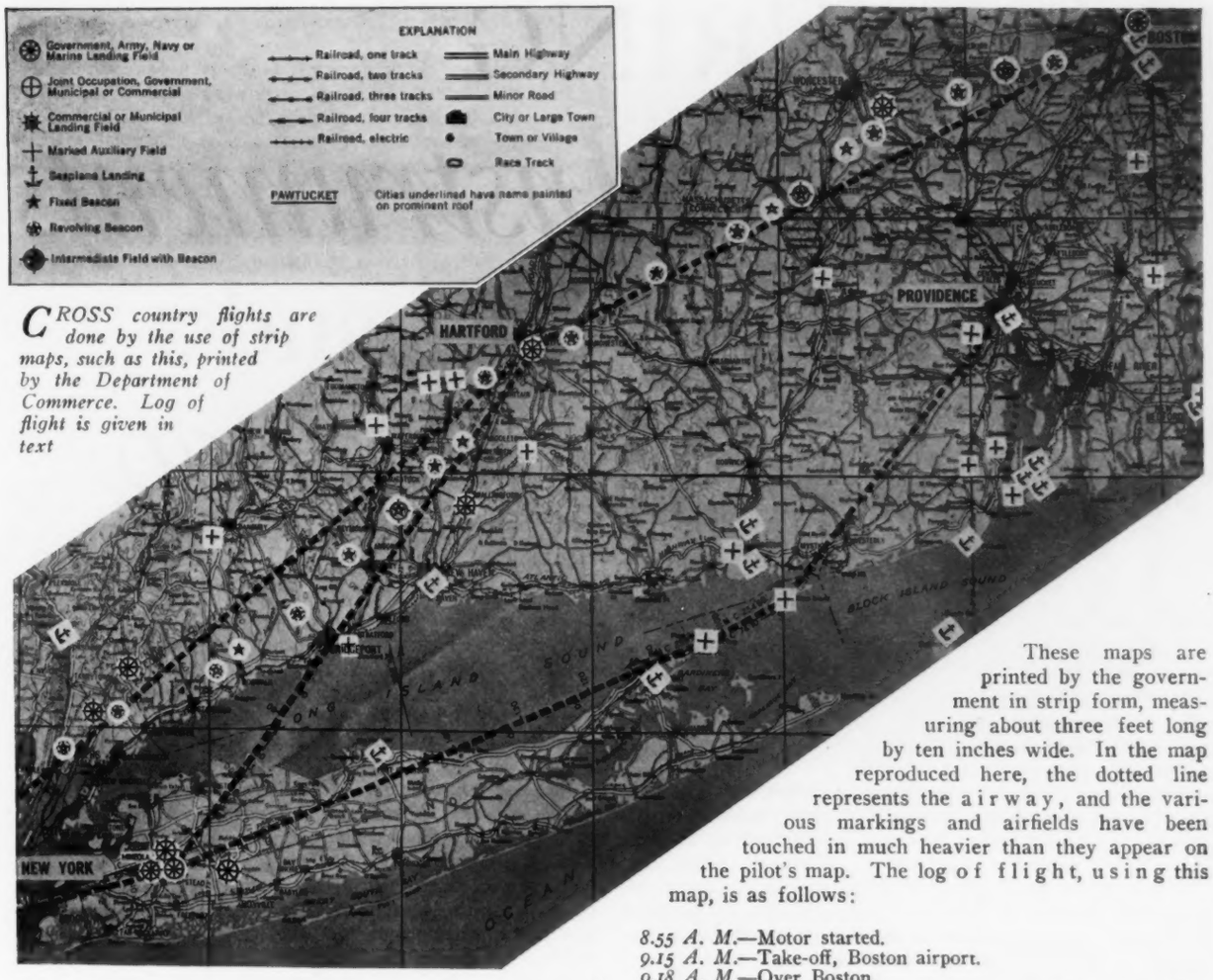
Plans are now under way for subjecting airplane radio apparatus to rather extensive tests, from which the company will undoubtedly derive a certain amount of publicity. The plane will be taken south, covering Miami, and as far inland as Nashville, Tenn. Arrangements are being made with different broadcasting stations along the route for rebroadcasting programs from the air. The idea is to have aeronautically or radio prominent personages broadcast a fifteen minute talk from the plane which will be picked up and rebroadcast exactly as was done over WOR on the arrival of the Graf Zeppelin.

There have been occasions in which the plane was used for pure publicity purposes. For instance, the plane was offered for carrying delegates of the International Aeronautical Conference from New York to Washington.

The question as to whether or not it would pay an electrical manufacturer to use an airplane is of course a question that cannot be answered arbitrarily. The value of an airplane to a manufacturer must be reckoned with little consideration for advertising value. An airplane is rather a common thing these days, and such publicity as has been derived from the Pilot plane has been due to the rather close association of two fairly spectacular things, flying and radio, combined in novel ways. From a purely commercial standpoint, then, the value of a plane depends upon the value of time which can be saved by it. Any decision to use a plane must then come from a comparison between this value and the cost of operation.

"For various reasons," says the aeronautics branch of the Department of Commerce, "no definite figures are available on costs in airway operation; nor are figures available on

At the Chicago Radio Show last spring the Pilot plane drew a great deal of attention. The above picture shows the fuselage of the plane being towed to the exhibition hall. This plane, with radio equipment, was also shown at the New York Radio Show



CROSS country flights are done by the use of strip maps, such as this, printed by the Department of Commerce. Log of flight is given in text

These maps are printed by the government in strip form, measuring about three feet long by ten inches wide. In the map reproduced here, the dotted line represents the airway, and the various markings and airfields have been touched in much heavier than they appear on the pilot's map. The log of flight, using this map, is as follows:

8.55 A. M.—Motor started.
9.15 A. M.—Take-off, Boston airport.
9.18 A. M.—Over Boston.
9.22 A. M.—Over outskirts of Boston—Dedham on right—Course 227, heading 6 deg. into wind.
9.34 A. M.—Right on course—Nattleboro on right. Thirty miles from Boston—ground speed 95 m.p.h.—air speed 110 m.p.h.—altitude 2500 ft.—visibility good.
9.40 A. M.—Over Providence—Narragansett Bay to left—Course changes—flying about 236.
9.47 A. M.—Single track R. R. crossing main road at cross-roads at river fork—River Point—speed 95 m.p.h. right on course—2900 ft.
10.00 A. M.—End of single track road—Hope Valley—a little S. of course.
10.05 A. M.—N. of westerly—climbing.
10.12 A. M.—Fisher's Island—4500 ft.—change course to 257.
10.15 A. M.—Over Long Island Sound—4500 ft.
10.20 A. M.—Plum Island—across Sound—4000 ft.—speed 95 m.p.h.—change course to 262.
10.39 A. M.—S. of course—over N. shore of Long Island.
10.49 A. M.—Rocky Point—speed 96 m.p.h.—2000 ft.—getting thicker, but not bad.
11.06 A. M.—See tank at field dead ahead.
11.09 A. M.—Curtiss Field—gun cut, coming in for landing—average speed 94.5 m.p.h.

Actually, no such log is kept; this is given here just to give an idea how flying is done by map. This map also illustrates the way in which airways are lighted for night flying, and how close together emergency landing fields are placed. These intermediate landing fields, as they are called by the Department of Commerce, under whose supervision they are operated, have a rotating beacon for guiding fliers to the field, and enough lighting equipment to outline the field and light a runway sufficiently for making a landing. No hangar service is provided, or other service common to terminal airports. The airway between Providence and Boston is not indicated on the map because this route is not lighted. Airway roof markings could not be indicated on the map.

costs of air service operations. There are given following, however, some reported costs, estimates and references. One experienced in airway operation has furnished the following data, using single-engined planes valued from $12,000 to $14,000." (The plane used by Pilot cost $16,000.)

	Cents per mile
Pilot	7.5
Mechanic	2.3
Depreciation	8.6
Fuel and oil	5.0
Hangar expenses	0.6
Insurance pilot	0.6
Insurance plane	0.48
Total	25.08

These figures were provided by an operating company, and will vary slightly from the operation costs of an individual. Regarding the costs of private air travel, the Department of Commerce says, "The operating costs of a standard three-place, 200 hp., open cockpit biplane, is but 16 cents an airplane mile—and these are, so to speak, 'crow-fly' miles."

A recent report of the Ford Motor Company states that seventy cents per mile is the cost of operating Ford all-metal, trimotored planes for freight service.

Individual manufacturers will use airplanes more and more as they become more and more air-conscious. There are millions of people in this country who have never flown and who are entirely unfamiliar with the process of flying. Some idea of the process of flying from Boston to New York may be gotten from the following log, and from some examination of the aerial map reproduced here.

MEASURING *Instruments* and *METHODS*

No. 2 of a Series on Electrical Testing Instruments and Methods

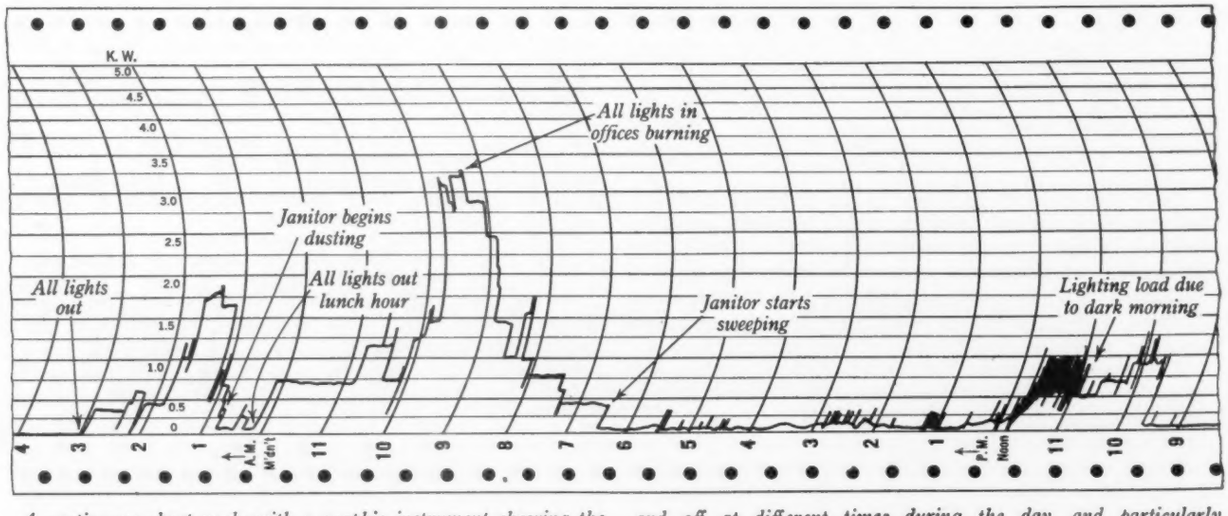
Graphic instruments providing permanent records of almost any kind of operation are available in many different types and they are used extensively for a wide variety of purposes in industry

By D. H. BRAYMER
Consulting Engineering Editor
ELECTRICAL MANUFACTURING

IN the first section of this series, the essential details of standard portable indicating instruments were presented, including information on the principles of operation, and specifications for selecting suitable types and ranges. In this section similar details will be given for portable graphic instruments and for those graphic instruments required for special tests.

Graphic Instruments.—In electrical testing instantaneous values of all essential elements of current, voltage, watts, power factor, frequency, etc., can be obtained by the use of portable indicating instruments. There are conditions, however, where much good judgment and experience are required by the user of these instruments if fluctuating conndditions are encountered and a reliable interpretation is expected. Even in the hands of an experienced tester, the indicating instrument fails to give much data that are essential to conclusively check impressions or inferences from the results of calculations and frequently it is necessary to get new and additional data in order to make sure that the first interpretation of the use of the indicating readings is correct.

The graphic instrument provides a continuous reading on a suitably ruled chart and besides showing instantaneous values for any time period also gives fluctuations over the complete period of time the instrument is connected in the circuit. These fluctuations make it possible for the tester to visualize many things which might easily go unnoticed and the record charts can be studied over a considerable period of time in an analysis of the conditions of operation and the performance of the machine under test. The graphic instrument is of decided value in those cases where there is a difference of opinion on the operating conditions or on things that may or may not happen in an electric circuit. The graphic record gives, with greater accuracy and in more detail, variations that might be observed by a tester if he were to be present and watching for these variations continuously over a long period of time, which is an



A continuous chart made with a graphic instrument showing the load factor on the lighting system in an office building. Note the fluctuations in the required load as the lights are turned on and off at different times during the day, and particularly the early morning period, when consumption was at its highest. With such charts accurate records of requirements can be learned

expensive and crude method of getting a record of the things that the graphic instrument will provide without any attention whatever.

The types of graphic instruments most used provide a record on a round or a strip chart which also furnishes a time scale so that readings can be obtained from the chart for any hour of any day during the period the instrument is connected in circuit. This time element is provided by a standard clock which controls through gears the rate at which the chart travels under the recording pen element. Thus with a record placed on a graphic instrument at 1 p. m. of any day with the pen element started at that time, the chart will record instantaneous values during each hour until the instrument is disconnected. In the strip chart instruments it is also possible to change the rate of chart travel from 3/4 in. to 12 in. per hr. to the same values per min. and thus stretch out rapid fluctuations in readings on the chart so that very small and very rapid variations can be closely and accurately studied. It is also possible to secure a special attachment for graphic meters that will provide chart travel in inches per sec. so as to record rapid movements of the pen element in such a way that an open curve is provided which can be easily and accurately read.

Various Types of Graphic Instruments

GRAPHIC instruments are available in portable types corresponding to nearly all the types that are available in portable indicating instruments, and in some types that are not available in portable indicating form. These portable types are as follows:

Ammeters, voltmeters, wattmeters, power factor meters, frequency meters, combination A. C. and D. C. voltmeters and wattmeters.

They are also available in special forms for special testing as follows: Kilovolt ampere meters, speed recorders, pressure and vacuum recorders, service and production recorders, condenser recorders, boiler water concentration meters with special features such as twin type mounting for two meter elements, and special attachment for automatically changing the speed of the chart travel from inches per hour to inches per second when an abnormal condition arises and it would be desirable to obtain a stretched out record of violent movements of the pen element during the period this rapid movement takes place and then return automatically to normal chart travel for normal pen movements.

Graphic instruments are available in several different makes but, as typical of this group of instruments, reference will be made to those manufactured by the Esterline-Angus Company, which specializes in the manufacture of only the strip type of graphic instrument.

Special Graphic Instruments.—In what follows the essential features of the special graphic instruments listed above will be outlined.

Kilovolt Ampere Meter.—An alternating current integrating wattmeter measures kilowatts instead of kilovolt amperes, usually abbreviated Kva., because of the fact that when the power factor departs from unity, the phase relation of the magnetic fields produced by the current and the voltage cutting the meter disc is changed. In order to make an instrument measure Kva., it is therefore only necessary to maintain at all values of power factor the same phase relation between the magnetic fields produced by the current and the voltage which exists when the power factor is at unity.

While the device shown above is not a graphic instrument, it serves to illustrate the type of construction employed in portable instruments that are now being used extensively

The Single Phase Unit Meter

THE single phase unit of the Esterline-Angus Kva. meter is shown in Figure 1. The frame F and the yoke S are made up of laminations. The two current coils C magnetize the frame F. In the polar space the potential element A is mounted so as to be free to rotate. It does not revolve like an armature, however, but only changes position with changes in power factor. The potential element A carries a polyphase winding, and when energized produces a rotating field about its periphery. The flux of the frame divides, the major portion crossing the gaps and cutting the disc at P and P, the remainder crossing the path formed by the potential element. There will, of course, be a reaction between this portion of the current field and the potential field, and since the potential element is free to rotate, it will always assume a position such that potential field is in phase with the current field. If the power factor of the circuit changes, causing one of these fields to lead or lag with respect to the other, the potential element immediately rotates enough to reestablish this phase relationship.

The element A does not move except to shift in either direction with changes in power factor but a flux is produced by the polyphase potential element on it, which rotates about its periphery at synchronous speed. The path of this potential flux through the disc between K and N is at right angles to the potential flux path from pole to pole through A. The element A always shifts so that the potential field is in time phase with the current field across the

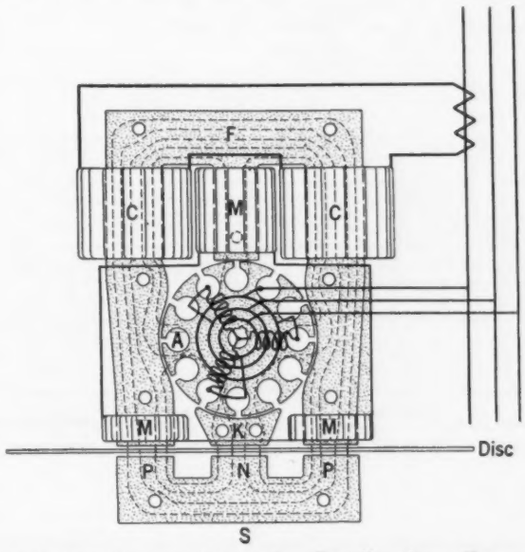
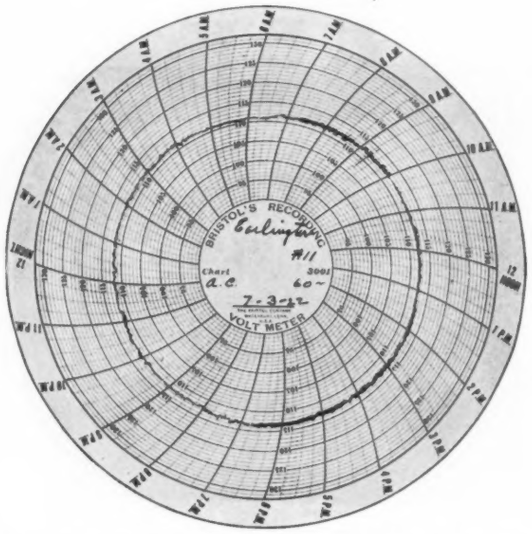


Figure 1 shows the general form of an Esterline-Angus Kva. meter element and the paths of the magnetic flux in a single-phase unit

polar space, but with the element A in this position the potential field across the disc between N and K will always be in time quadranture with the current field. This being the case the torque on the disc is the same as if the power factor were maintained at unity and the instrument thus measures volt amperes at any power factor.

The foregoing description covers the operation of the single phase instrument. The three-phase meter consists of three single phase units acting on aluminum discs which are mounted on a common staff. These all tend to drive



Another type of graphic instrument recording chart that is commonly employed covering voltage recordings for a period of twenty-four hours

the disc in the same direction of rotation and the torque produced is in proportion to the arithmetical sum of the volt amperes in the three elements, so that the pen records the volt amperes in the three phase circuit. Damping is obtained by means of a permanent magnet acting on one of the meter discs.

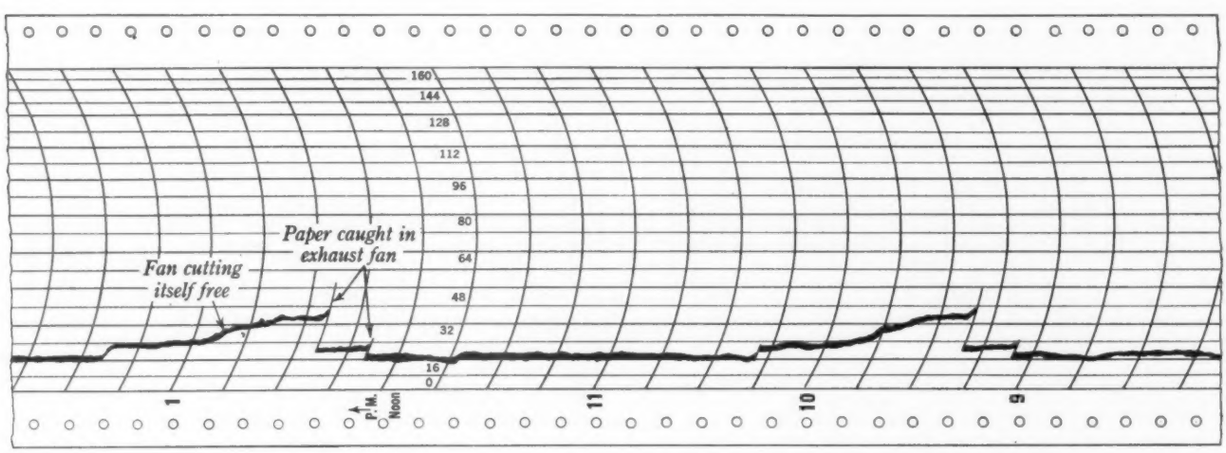
The current coils of the Kva. meter are wound for 5 amperes at full scale. This meter can be furnished with potential taps for 100, 200 and 500 volts nominal range with equally good accuracy on values of current or voltage 35 per cent above or below these nominal ranges. Portable instruments are available with all or any combination of these voltage ranges. These instruments can be used only on the frequency for which they are calibrated. In the portable type they should be used with the leads that are provided.

Speed Recorders.—This meter consists of a graphic voltmeter operated in connection with a magneto type generator which is driven by the machine for which the speed is to be recorded. The magneto generator used is designed especially for the meter and gives a voltage which is directly proportional to the speed at which the armature is rotated. These recorders are available with a zero at the left end of the scale or with a center zero scale or so that the zero can be shifted from one position to the other. These speed recorders are calibrated to record revolutions per minute, feet per minute or miles per hour when these values have a direct relation to the speed of the generator of between 500 to 2000 r. p. m. Step down speed reductions make it possible to record speeds higher than those at which the generator is operating.

Selecting the Proper Meter

WHEN selecting this meter it is necessary to know the speed of the machine which is to be recorded and the exact ratio of the drive to be used. The portable speed recorders have self contained resistances. The meter can be used several hundred feet from the generator by making connections with No. 10 B. & S. wire for the leads. The length of these leads however must be known when the meter is being calibrated. These meters can be provided with chart speeds of from 3/4-inch and upward, per hour, per minute and per second.

Pressure and Vacuum Recorders.—These meters can be used for recording pressures of steam, air and other gases or liquids that are not injurious to metal. Low pressure types are available in ranges from 5 in. to 50 in. of water. High pressure types can be secured with a range up to 5000 lb. per sq. in. These instruments should be used on one range only with charts selected having a scale to suit. The low pressure meters make use of a sylphon type mechanism while the high pressure meters employ the standard Bourdon tube in the Esterline-Angus designs. The vacuum recorders have a standard range of zero to 30 in. of mercury. These meters all have zero marking at the left hand end of the scale. Chart speeds of from 3/4-in. and upward per hour, per minute and per second can be secured. The pressure and vacuum elements of the meters can be mounted in a twin type case for switchboard mounting, which makes a very suitable arrangement.



When this record was made to check the performance of a motor driving an exhaust fan, it was descovered that a piece of paper had become entangled in the fan, thereby overloading the motor, as is indicated on the chart. Graphic instruments are valuable aids in such instances as this and will be found of material assistance in checking the performance of many other types of equipment

Schooling New Men in Engineering Fundamentals

Manufacturers must train engineers, college courses being inadequate. Westinghouse Electric & Mfg. Company at East Pittsburgh continues its one year course for engineering graduates, supplemented by a course of study at the University of Pittsburgh

By Roger L. Knight

Associate Editor Electrical Manufacturing

ELECTRICAL manufacturers must train engineers. Why? Because engineers cannot be trained to meet the exacting requirements of modern industry in any four-year college course in engineering. College courses in engineering have been four years long for many years, during which time the training demanded of the practicing engineer has increased a great deal more than the provisions of the colleges for giving this training. The problem that is up to every electrical manufacturer, then, is how much training, and what kind?

The training system of the Westinghouse Electric & Mfg. Company, East Pittsburgh, represents what this company considers necessary for training first class electrical engineers. In considering this system it is of great importance to investigate the significance of certain new phases. For many years this course for graduate engineering students consisted of a year of training in the various company shops. Within the past year, this course has been greatly added to by organizing a cooperative course of study with the University of Pittsburgh. In addition to this, the necessity of a few especially highly trained engineers has induced the company to institute a special three-year training program for a select number of students. This added training costs money, but it is an investment, which this company considers sound.

¶ Executives and technical experts are chosen from those who show capacity and who enter the organization directly from engineering schools, as the personnel shows

For more than 35 years the Westinghouse Company has filled the ranks of its executives and technical experts from among those who show capacity and who enter the organization directly from engineering schools. The company believes in graduates of technical schools. Most of its principal executives, including vice-presidents, departmental managers, district sales manager, works managers, service managers, and engineers entered Westinghouse service directly from engineering schools. There are about seventy colleges and universities from which this company makes an especial effort to enlist students for the graduate course. The fundamental idea of selection is to enlist a few men and keep them rather than to enlist a large number for the course, and weed them out later on. In thin years and thick years, the number of students taken into the company is within the small range of three hundred per year. The operation of training is independent of the business cycle.

¶ Student selection for the engineering course depends upon plans after graduation, personal qualifications, scholastic standing and extra-curricular activities at college

Most engineering students are drawn from a special list of about fifteen colleges, known as scout schools. Some time during the year there is sent to each of these schools a student, generally one who was graduated from this school the previous year. This student, known as a scout, describes to the senior electrical and mechanical classes the purposes and methods of his company's student course, and makes an appointment with each student to meet a member of the company's Educational Department, who follows the scout by three or four days.

The scout's functions are to describe the course, answer any questions regarding it, and to make a detailed report on each student in the graduating class. This report includes the plans of the student after graduation, his personal qualifications, and in general whether or not he is a desirable prospect and whether or not he is likely to be available for employment. In considering the desirability of students, attention is paid to such things as his scholastic standing, his personality as it appeals to the interviewer, his extra-curricular activities, and his reputation among the instructional staff.

At the time the new student enters the course he is urged to develop himself naturally, and not try to fit into work for which he is not adapted. "The most successful men in our Engineering Departments," says one executive, "are those who have followed their natural bent or characteristics and utilized their natural aptitudes in their work. Therefore, the young man beginning work with us and looking forward to entering the Engineering Department should carefully study his own characteristics and aptitudes, rather than his mere preferences or the suggestion

of others, in determining the field of work he is to follow."

New students are also advised as follows: "Young men should also understand the positions that are easiest to attain offer the least reward eventually and that it is only through years of hardest kind of effort in any line of our engineering that one can become a real leader."

When the new student comes into the big plant at East Pittsburgh, he usually feels "lost" for a time, and to help him get over this bewilderment as soon as possible, the student is given considerable freedom for a few days, so that he may acquaint himself with the physical features of the plant. He is given a book to read, entitled "Work and Opportunities in the Westinghouse Organization," which consists of letters from the various department heads describing the organization, work and opportunities of their departments. Also he meets other students and instructors at conferences which help him to get acquainted.

¶ New engineers are especially urged to develop themselves according to their natural aptitudes. The work of various types of engineers is explained as clearly as possible

Within the first month the new student is required to make a choice of the branch of engineering work he wishes to pursue. He has one of three choices—research, application, or design. This choice is made on the basis of what the student has read about the different fields, his observation and contacts in the plant, and his interviews with members of the Educational Department. As has already been mentioned, a particular effort is made to direct the student according to his natural aptitudes. The spirit of the educational plan for engineers is well reflected in the following statements prepared by the educational committee of the Engineering Department, which the student is required to read carefully before studying in detail the work of the various departments.

"Our broader type of engineers," says the committee, "no matter what kind of work they are in, will sooner or later come in contact with customers and customers' engineers. There is an idea at present that only the general engineers get outside or get into contact with the customer. It should be clearly understood that the design engineers and the research engineers also must have such contacts though this contact usually does not come in the earlier years, but after the engineer becomes experienced enough to deal properly with outsiders.

"It is a common idea that our design work is more or less of a routine nature and that in most cases the designer simply sits at a desk and works out details of some part or piece assigned to him. The good designer does not work 'piece meal,' but when he is assigned to the duty of getting a certain result, he is expected to get it and is held responsible for getting such result. If he becomes a mere routine man, it is because he has allowed himself to get into such a condition.

"There is also a fallacy among some of the college men that design work is narrowing, when, in fact, the opposite is the case, for the designer comes into closer contact with engineering fundamentals than anyone else, due to the nature of his work. For example—attention is called to the fact that many of the electrical engineers today, both here and abroad, who have national or international reputation, are men with considerable design experience. Apparently, this has broadened them and given them a grasp of fundamental principles which has assisted materially in their professional standing. All branches of our engineering work are equally broadening, if properly carried out."

When the student has familiarized himself with the spirit of the training course and of the engineering departments of the company, he goes before the educational committee of the Engineering Department for a personal interview, after which he is definitely segregated for some particular branch of engineering, and is given a definite program for the remainder of the year. For all three groups—research, application, and design—the program is divided as follows:

(Engineering laboratory is substituted for Test work for the research group).

Manufacturing work.....Three months
Test work.....Four months
Engineering school.....Three months
Other assignments.....Two months

All of these assignments, except Engineering school, vary according to the branch of engineering work the student selects as his specialty. Manufacturing work in each case includes assignments to assembly and feeder sections of the shop, not to exceed one month in each. The important point in these assignments is to gain the manufacturing viewpoint and an acquaintance with shop practises and with shop men. As far as it is possible to do so, these assignments to shop sections are made in line with the type of apparatus handled by the department to which final assignment is desired.

Engineering laboratory work for the Research group includes work of a research or development character in the Research laboratory and the Engineering laboratories located at the works, the high tension laboratory, and the Standard house.

Test work of four months includes assignments to at least two test sections for two months each. These sections are selected as far as possible according to the student's specialty.

¶ Engineering school is three months long, and consists of classes conducted by engineers, the purpose of which is to acquaint new engineers with Westinghouse products

Engineering school of three months is conducted for the purpose of acquainting the student with the engineering features of Westinghouse apparatus. During this three months, the student spends all of each day either in class room or study session. Questions are prepared on the various apparatus, and these serve as an outline for the student's work. These questions have been prepared by members of the various engineering departments, who also conduct engineering school classes. During that part of the year not taken up by Engineering school, apparatus classes are held weekly further to acquaint the student with the company's apparatus. These apparatus classes are attended both by engineering and sales students, and are more for the purpose of promoting the commercial point of view than for acquainting students with the strictly engineering features of apparatus.

Other assignments—two months—is a general assignment allowing for flexibility. This assignment may be to work at other plants, in the laboratories, field work, or office work in the engineering departments. Occasionally work in the engineering departments is allowed as a part of the schedule in order that the student may become familiar with the type of work done by the department before definitely committing himself to accept a regular position in that department. On the other hand, it enables the departmental manager to gain some idea of the personality and adaptability of the individual to the special problems of his department.

From the men who complete the Engineering school, a few who show aptitude for more highly specialized work

are selected for six months of individual instruction in the solution of special design problems. Design school varies from Engineering school in that it does not concern itself primarily with particular products but with fundamental design problems. This work is similar to that done in graduate schools of universities. In fact, work in Design school may be applied toward a Master of Science degree at the University of Pittsburgh. Appointments to Design school are not preferential, but the training is conducted to fill a definite need for a few highly specialized designers. There are two separate design schools, one conducted for electrical designers and the other for mechanical designers. The schools are of the same duration and are of the same fundamental nature. Design school may or may not be substituted for other assignments during the first year of the student's training. In case the year's course is completed within the period of assignment to Design school, graduate students are transferred to complete the work at the Design school, while assigned to a regular department.

A recent and unusual outgrowth of the Westinghouse engineering course is the three-year training program for preparing men apt in the use of their hands and of good technical background for the more unusual problems of instrument and apparatus design and development as opposed to heavy machine design. This plan was initiated about a year ago, and is significant in its indication of the increasing demands of modern engineering training.

Men selected to take this three-year course go through the first year on the regular program, including Engineering school, and at the end of the year they go on regular in the Materials and Process Engineering department. It is expected that candidates for this course will qualify for Design school in the regular way by passing suitable tests and by doing satisfactory work so that they may undertake a part of the Design school work beginning August first of their second year. During their second year they will be given special instruction for two months on fundamental conceptions of circuit rupturing, and two months' instruction covering mathematical analyses of polyphase circuits, with particular reference to so-called symmetrical coordinates, and two months' instruction on slow transient circuit conditions. During the third year these students will complete that part of the design school work which they did not complete during the second year. Also during the third year they will be given two months' special instruction on surges and lightning-arresters, laboratory work (covering reports, analyses, etc.), development budget system, principles of management and development of executive ability, and shop organization and management, covering wage payments, costs, materials, tools, and miscellaneous manufacturing problems.

The purpose of this three-year course is to give the engineer the broadest possible foundation for design work, and to develop an occasional *super-designer*.

¶ Cooperative courses at the University of Pittsburgh lead to M. S. and Ph. D. degrees. Twenty-five men will receive their masters degree in June, 1929, from this course

Pointing further to the development of high trained engineers is the cooperative course conducted by the Westinghouse Company with the University of Pittsburgh. This cooperative plan makes it possible for designated employees of the company to register in the graduate school and receive resident university credit for work done within the walls of the industry under the guidance of practicing engineers, this work ultimately leading to an M. S., or Ph. D., degree. All courses are conducted by Westinghouse engineers, and cover a wide range of subjects in the fields of physics, mathematics, research, laboratory technique, and machine design both from the electrical and mechanical viewpoints. The work involved in the electrical and in the mechanical groups is intensive in character and is embraced on a fulltime basis within the compass of six months. The work of the three-year program has been mapped out to meet the needs of those men who, in parallel with this training, are taking up the more advanced work in the development and engineering laboratories of the company. About twenty-five men will receive their master's degrees in June, 1929, as a result of this cooperative course. In addition to the machine and apparatus design courses there are classes under university professors conducted on Westinghouse property and for Westinghouse men. They include differential equations, advanced calculus, partial differential equations, mathematical physics, vector analysis, thermo dynamics, and economics.

¶ Especial emphasis is laid on the training of mechanical engineers. Higher operating speeds and temperatures place highly trained mechanical engineers in great demand

Some of the most important improvements that have been made on electrical machines in recent years are improvements of a purely mechanical nature, which has induced the Westinghouse company to lay particular emphasis on the problems of training mechanical engineers. Introduction of higher speeds and higher operating temperatures is resulting in such radical changes in mechanical design that mechanical engineers of the highest type are in imminent demand. Mechanical engineering is a more approximate art than electrical engineering; hence men who will solve important mechanical problems must be men strong in vision and imagination. To train such men is a problem even more difficult than the problem of training electrical engineers. Due to the nature of these mechanical problems, the student is trained to develop his solutions from the most fundamental concepts. In the mechanical section of the Research Department, the student is instructed in the methods of conducting experimental studies of mechanical properties of materials and in conducting analytical studies of stress distribution and vibrations in machine parts. In its experimental work, this section does not perform routine tests, but concentrates on investigations of fundamental problems. The student is also introduced to the fundamental studies of vibration and of stress distribution.

On paper the program of the mechanical engineering student is about the same as that of the electrical student, but the course is actually carried out differently, in accordance with the difference in the type of problems the two are to solve when they are placed in the Engineering Department. The first few months are taken up with manufacturing work, after which the student is given a brief assignment to an engineering department in order that he may discover his real interest and aptitudes. Following this assignment, students are given further training in test and laboratory departments in the direction of any developed interests. Engineering school for mechanical engineers is the same as for electrical engineers, but, as has been mentioned before, mechanical engineers are given a special Design school. In mechanical Design school, the following subjects are studies: Applied elasticity, vibration phenomena, heating and ventilating of electrical machines, and physical metallurgy.

For many years Mechanical Design School was limited to ten or a dozen men, but this school is now being enlarged to provide for increasing demands. Mechanical engineers also profit by the cooperative course with the University of Pittsburgh.

Station G-A-G-E, Editor Speaking

Stanley A. Dennis, Editor and Assistant to the President

Aviation and the Manufacturer

AVIATION in America offers to the electrical manufacturer both a splendid market and a magnificent opportunity for service. Aviation in this country demands more electrical service than aviation in any other country because flying distances here are so great that not only is night flying essential but weather conditions are so variable that a vast electrical communication system for reporting weather conditions to pilots during flights is becoming more and more necessary. The extent of our country necessitates an amazing number of airports and a great mileage of airways. And electricity is essential to the use of both airport and airway.

The airport market for electrical service in America is visualized on page 22 of this issue of ELECTRICAL MANUFACTURING. Doubtless the number of existing airports as well as the number of proposed airports will surprise many electrical manufacturers. And it must be remembered that the page referred to does not indicate the 4000 or more fields on which landings can now be made by daylight but which can hardly be called airports. Nor does the illustration indicate the vast airway mileage which is also part of the aviation market for things electrical. Inspection of the electrical equipment required by the Department of Commerce for the intermediate landing fields (directly under the Department's control) reveals an interesting bill of materials for the necessary equipment and for its installation. Much of this material is now sold through electrical channels, and more of it can be sold through such channels. And electrical contractors in increasing number are installing both airport and airway equipment.

Equipping these airports and airways with adequate electrical service spells progress in aviation. It is generally agreed by American flyers that the growth of aviation depends upon more and better landing fields, well-lighted airways, and an adequate weather service at all times. The importance of this market for the electrical industry has been stressed by the Department of Commerce, which has done a great work for aviation since the passing of the Air Commerce Act in 1926. Says the Department in a recent report:

"America today is doing a prodigious amount of civil flying. A great transcontinental system of air mail, express, and passenger service rapidly growing, has been in actual operation for two years; air service operators are flourishing in hundreds of cities; executives are flying their own airplanes in the conduct of daily business; more than a thousand airports are in existence; and the manufacturing industry is far behind on its orders."

In looking into the future, there is every reason to believe that American aviation will grow much more than in Europe, although at the present there is more flying done in Europe than in America. General flight in all its phases has arrived and is doing business. Every town will have its operators and private owners of aircraft which must be serviced just as automobiles, motor boats and other transport facilities. The first airplanes in a town mean some kind of an airport. Flight from town to town at night means airways. Just as the automobile demanded good roads, so the airplane demands good airports and airways. The adequate electrification of both can be speeded up immediately, if electrical manufacturers everywhere, and other industry groups, will take the initiative whenever and wherever possible.

Graphic Instruments An Asset

GRAPHIC electrical instruments are more frequently used now for different purposes than the familiar indicating instruments such as the ammeter, voltmeter or wattmeter. In such cases the electrical element is the mechanism which makes the record possible, and little knowledge is required about the operation of the instrument itself. But one must have some understanding of the details the records show, and how to apply them in a practical way.

In an article appearing in this issue on the subject of Measuring Instruments and Methods, a good example of this is shown. We refer to the diagram on page 46 which gives some interesting information on things that happened on a certain day in an office building. For instance, this record shows when the janitor began dusting with his vacuum cleaner, whether or not all the lights were put out when offices were closed for the lunch hour, the total power taken when all lights used in the building were burning and the power taken by lights required because of a dark and cloudy morning. All this information was shown on the record taken by a graphic wattmeter, but it is certain that the manager who caused this record to be made could have known the instrument under any other name just as well, as far as his interest in the mechanism was concerned. Furthermore, after a little experience in examining the record from this instrument he could tell almost as much about the electrical requirements of his building as his most experienced electrical man, for the record gives unfailing evidence of just what happened hour by hour during the day.

Another case comes to mind where the production superintendent of a plant noticed that the output in parts from a certain manufacturing department seemed to be falling off for no good reason. A graphic wattmeter was connected in the electrical feeder circuit to this department and what is known as a load curve was obtained for the machines electrically operated. All of these machines were supposed to start together in the morning, all stop at noon, then start again at 1 o'clock and all shut down again at 5 o'clock at night. The load curve showed that in the morning and just after lunch the employees had formed the habit of actually getting their machines into production slowly, requiring about an hour in the morning and about an hour just after lunch before they were up to full production. Again they anticipated quitting time at noon and also closing time, and allowed the production on their machines to lag. This was also clearly shown in the record by the sloping line for about an hour before noon and before 5 o'clock. From this record it was evident, then, that the production at full rate from the machines was a little over five hours a day while the employees were paid for nine hours' production time. This loss of production time from the machines at the reduced rate represented a production loss to the manufacturer of about $75,000 a year. Such a discovery by the use of a

graphic record creates a wholesome respect for the relatively insignificant mechanism that made it possible. Incidentally this record demonstrated the value of the use of time clocks to remedy the situation.

Hence, the graphic record provides the means for a business study of many things that in the press of other matters go unnoticed until they have grown to considerable proportions. The real trouble is that most of us do not know enough about graphic records and how to apply them to our business. Because the mechanism is an electrical instrument and in good quality costs about $300, the initial cost and the supposed intricacy of the device too often looms out of proportion to the importance of the need for it. Here is where a business blunder can easily be made, for a graphic instrument used a majority of the time to find out something that you do not know about your business is cheap at any price and you are paying for it in any case whether you buy it or not. The real question is how many you should have in operation to stop the leaks you know are somewhere in your system and should be eliminated.

Nema and League Finances

LEADERSHIP of a very definite kind is manifest in the action taken in January by the National Electrical Manufacturers Association with reference to the financial support of local electrical leagues by the manufacturers. The resolution passed at the midwinter session of Nema offers what many leaders in the industry hope will be a satisfactory solution to what has been a difficult problem.

No orderly procedure has been followed by the manufacturers in making their contributions to the leagues; many small manufacturers have been embarrassed by requests for support by many leagues and have complied with none of these requests; and all manufacturers have found it difficult to determine the correct amounts that should be contributed to the various leagues. How to distribute this support fairly among the manufacturers and how to disburse funds to the leagues on an equally fair basis has vexed even those executives among the manufacturers who were willing to do their part in promoting commercial development of the electrical industry in the localities covered by the leagues.

Under the resolution passed by Nema, a Board of Trustees is to be nominated by the various electrical manufacturers associations and approved by The Society for Electrical Development. This Board of Trustees will collect the funds subscribed by the manufacturers of electrical supplies, material, apparatus, and appliances. The amount contributed will be based, as far as possible, on a percentage of sales. This board will allocate the funds to the leagues on an equitable basis. It should be noticed that this board is to be composed of manufacturers who are members of Nema and non-members as well. A committee of eleven Nema members has already been appointed to serve on this board. Other manufacturers associations, as the Artistic Lighting Equipment Association, the American Washing Machine Manufacturers Association, the Vacuum Cleaner Manufacturers Association, the Ironing Machine Manufacturers Association, and the Radio Manufacturers Association, should also be represented on this board as promptly as possible.

Certainly this plan should meet the approval of electrical manufacturers everywhere. To every manufacturer it offers the opportunity to make one contribution annually to league support and to escape solicitation by numerous leagues, or if solicited to refer the request to the board. Manufacturers who fail to cooperate with the board will continue to receive requests from the leagues for financial support. The new plan should appeal to fair-minded league executives and should help to stabilize league finances. This action by Nema deserves the enthusiastic commendation and support of the entire manufacturing group.

Exporting from Fresh Water Cities

IF any electrical manufacturer still thinks that only salt water cities are and should be interested in foreign trade, that manufacturer must be blind to the trends and the facts of the hour. Today American business has its face turned toward foreign trade as never before in this generation and perhaps as never since the days of the famous clipper ships that carried the flag into every foreign harbor. Not only the manufacturers located in or close to salt water cities are turning to the foreign market for business, but the manufacturers located on fresh water cities are doing the same thing.

A recent survey by the Chamber of Commerce of the United States shows that sixty-nine local chambers of commerce now maintain foreign trade bureaus. And the number is increasing monthly. Some of these bureaus are located in fresh water cities, many hundreds of miles from the seaboard. Akron, Atlanta, Chattanooga, Des Moines, Evansville, Fort Wayne, Keokuk, Omaha, Spokane, and Wichita are now looking beyond the shoreline toward foreign markets, not to mention the large industrial centers such as Chicago, Kansas City, and St. Louis.

When the electrical manufacturer lays his plans for tomorrow's business, let him not overlook the foreign market. In almost every country in the world the electrical industry is making progress. In many of the countries of South America and Europe numerous electrical projects are under way, which should greatly stimulate the market for all kinds of electrical products. The American electrical manufacturer can compete in this market profitably. He should plan to develop it without delay.

The Square Deal Still Brings Results

IN the opinion of some executives, labor is more easily handled today than formerly because we have a better understanding of the fundamentals of economics and have a better conception of what business is all about. A different opinion is expressed on pages 25-27 of this issue of ELECTRICAL MANUFACTURING in an interview with Albert I. Appleton, president and treasurer of Appleton Electric Company, Chicago, by Leon I. Thomas.

"Labor has always been easy to handle," says Mr. Appleton. "It is true that times have changed and this has brought new environments, but men respond now to the square deal as always."

The problems of electrical manufacturers as well as those of all other manufacturers finally resolve themselves into problems of handling men. The plant production problem, for example, is greatly simplified when the workmen are provided with plenty of light in the shop, up-to-date machines and tools that are kept clean and in repair. Cleaner working conditions are the best remedy for slovenly workmanship. In the last analysis providing these things for the workmen is just a part of the problem of giving them a square deal.

Management policies such as this are not like suits of clothes that must be discarded after a time and new ones obtained. The fundamentals of sound management have not been changed by advancing standards of living.

DIRECTION of GRAIN in Making

METALS will form better across the grain than with the grain and this characteristic should be carefully considered in the design of parts where strength and flexibility are required

No. 2 of a Series on the Design and Manufacture of Stampings

By J. K. OLSEN
Chief Draftsman, Stewart-Warner Speedometer Corp.

THE surface of sheet or strip stock may appear smooth to the naked eye, but when magnified sufficiently these same surfaces will show stripes and ridges running lengthwise of the material similar to the condition shown in Figure 1. This condition is a physical property of all metals and is commonly known as the grain direction.

It is a well known fact that metals will form or bend across the grain better than with the grain, therefore this characteristic should be carefully considered in the design of parts where strength and flexibility are required. Special attention must be given to parts having a sharp right angle bend. In such cases the bend must be across or approximately across the grain of the material in order to obtain parts which will not crack or break when bending or forming.

The right angle part, illustrated in Figure 2, would of course necessitate a proper arrangement of blanks in the strip layout to conform with the grain requirements of the piece and this, in turn, would increase the amount of raw material used to a point well beyond that which would be reached without the grain restriction.

In line with the above practice as used in connection with the sharp right angle bend, all blanks for bent parts should be laid out as much as possible to maintain the proper relation between the bend and the grain of the metal. However, the grain direction need not necessarily be exactly 90 deg. from the bending line, as any position of the bend in relation to the direction of the grain up to 45 deg. should in most cases give satisfactory results.

In small bends, such as 45 deg. or less, we may generally ignore the direction of grain, owing to the slight chances for cracking and breaking in parts of this type.

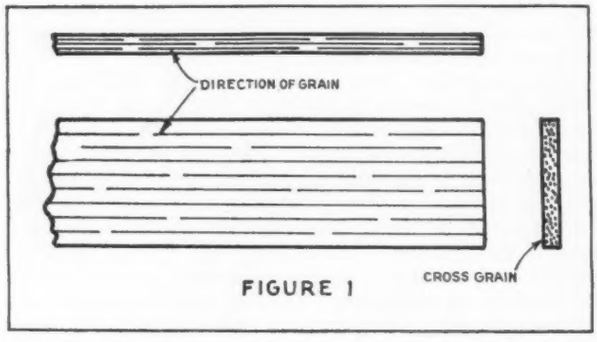


FIGURE 1

Special attention must be given to parts having a right angle bend. In such cases the bend must be across the grain to obtain parts which will not crack or break when bending or forming

Included in the illustration, Figure 2, of a right angle part are three material layouts; the first of these show the maximum obtainable strength. This would be the layout used only when a rigid standard of strength must be maintained.

The second layout shown would be the one adapted in most cases, as the factor of strength is very nearly equal to that of the first layout, due to the fact that the right angle relation between the part and the grain is only deviated from slightly. The material saving, as may be noted by a comparison of the weights per 1000 pieces, is quite an item in favor of the second layout. The third layout is shown only as an example of a case which should be avoided, as the bend would be in line with the direction of the grain and this arrangement of blanks would no doubt result in the cracking or breaking of parts. This last layout would use more material than the second one which will, of course, be an additional disadvantage.

In summing up these facts it should be noted that the incorporation of a specific grain direction in any part should be a definite engineering requirement, and the responsibility for any extra material used in this respect should be chargeable directly to the functioning of the part.

In the previous example, Figure 2, the material layouts were shown to illustrate the effect of material grain in relation to the strength of a bent part.

In Figure 3 is given an example of a part having lugs which are used as a holding means and must be clinched or bent over after assembly of the part. In this phase of design the use of material grain is applied with an idea in mind which is very similar to that which was used in the bent part, illustrated in Figure 2. The fact that metals will bend or form better across the grain than with the grain may be used to good advantage in parts of the above type, to insure free bending of the lugs with a minimum chance for cracking or breaking. In all layouts for parts with this kind of lug, it is therefore important that the grain is made to come as much as possible in the desired direction. The importance of grain direction will, of course, vary in different designs, as in some parts the lugs may be required to stand repeated clinching and unclinching.

Grain in Metals Important in Stampings

THE incorporation of a specific grain direction for any part should be a definite requirement and the responsibility for any extra material used should be chargeable to the functioning of the part

Below, the illustration of the part with the lugs attached, in Figure 3, are shown three material layouts for the part; each of these may be used depending upon the tool layout for the part.

The first layout shown is perhaps the most wasteful of raw material, as may be noted by a comparison of the weight per 1000 pieces.

The second layout proves to be the most economical in respect to raw material; however, owing to the alternately reversed position of the blanks, it would be found that the stock would have to be re-run or, providing the production were on a large enough scale to permit it, a die could be made to handle both blanks at once.

The third layout will probably be found the most suitable for average requirements, as the material wasted is only slightly more than that of the second layout and the tool layout is much simpler.

Figure 4 shows another of the many cases in which the grain direction is considered to obtain better forming, that of the double seam.

In this type of design the previously mentioned fact that metals will bend or form across the grain better than in line with the grain and with much less possibility of cracking and breaking should be incorporated. This will insure a smooth, even bend and a uniform product.

In all classes of parts closely related in type to those we have mentioned and in any parts which must be formed or bent to a considerable extent, the effect of grain in relation to the bending point should be considered as one of the most important factors of the design.

In parts of the type illustrated in Figure 5, we must consider the effect of the grain of the metal with a different idea in mind. In the former cases we have considered the direction of the grain of the metal to provide strength, ease of forming and similar features; however, in the case of the above part, the characteristic action of the metal is involved.

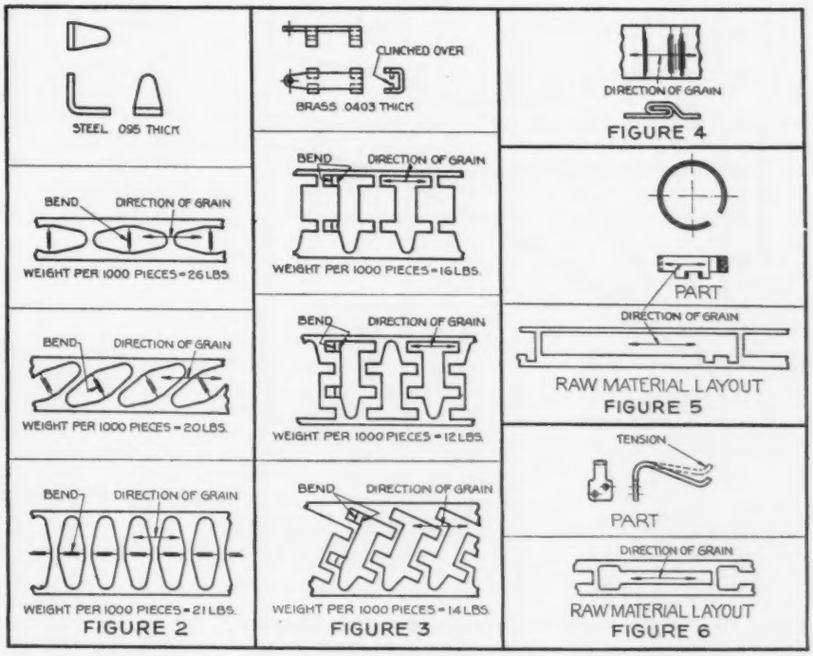
The main point to be noted in the design of thermostatic parts is that the metal will swing or move with the grain. Therefore, it is common practice to specify the grain direction of the metal on drawings of parts of this type.

In Figure 6 we have an example of a formed spring; this type of part represents one of the most important and widely used problems in which the relation of material grain to the bending direction is considered.

The grain direction as applied to springs is considered for the purpose of giving the part greater tension and flexibility in addition to longer life.

In the design of springs of the above type it is necessary to specify the material grain in such a direction as will allow the formed corners and all other bends or bending stresses to come at 90 deg., or as near this figure as possible, to the direction of the grain.

In many cases this grain requirement will increase the amount of raw material required to a great extent.



At the left above in Figure 2 is shown the layout of a plain right angle piece with grain direction considered. The middle illustration, Figure 3, shows an example of a part having lugs for clinching after assembly of the part. The metal must be bent across the grain in parts with double seams as in Figure 4. In forming parts of thermostatic metal the grain direction must be lengthwise of the piece as in Figure 5. Proper grain direction in formed springs, Figure 6, is considered from the standpoint of flexibility and greater tension in addition to longer life

Characteristics That Determine the *Selection* of MOTORS

No. 9 of a Series Discussing Motors of Different Types

In the selection of motors for their many respective applications the selection of the proper control should also receive careful consideration

BY THEODORE SCHOU
Consulting Engineer,
Fairbanks, Morse & Co.

AND

C. P. ROBINSON
Synchronous Engineer
Ideal Electric & Mfg. Co.

IN the previous articles of this series the characteristics, operation and applications of many different kinds of motors have been discussed. In what follows the selection of the proper control for the motor is explained, together with the respective applications of additional types of motors.

(c) *Variable Torque—Variable Horsepower:* This is still another type of multi-speed induction motor that has a field of its own. Built in either the two stator winding, or reconnectable type, the characteristics of this motor are similar to those shown for the other types. Figure 23 shows the power factors for this motor which is rated 25 hp. at 900 r.p.m., and 7½ hp. at 450 r.p.m. Figure 24

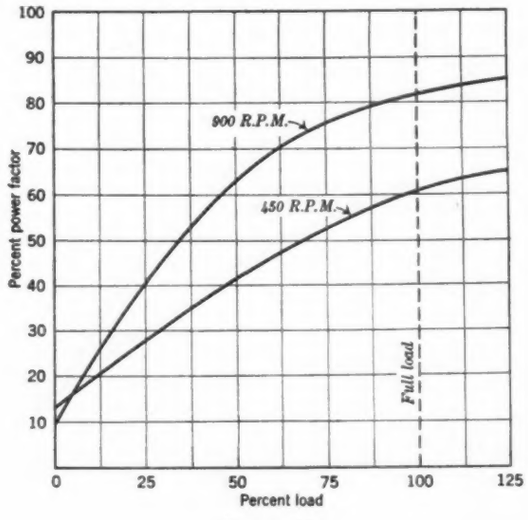


FIGURE 23

This chart shows the power factor for a variable torque, variable horsepower motor, rated at 25 hp. at 900 r.p.m. and 7½ hp. at 450 r.p.m.

shows the current inrush characteristics and Figure 25 shows the torque curves for the same motor.

This motor is suitable for fan duty, pump drives, and any type of machine-tool duty or other application where the torque required does not vary directly with the speed. For instance, in such applications as fan drives, blowers and centrifugal pumps, the torque required is considered as varying as the cube of the speed. In other words the variable torque motor is suitable for any drive where the torque required varies as some even power or fractional power of the speed rather than in direct proportion to speed change.

In general, as regards machine-tool duty, such motors as these, either constant torque or variable torque types, according to the A. I. E. E. ruling would be given a rating of one hour, 50 deg. C. rise. This means an intermittent rating. However, many manufacturers are demanding motors rated one hour, 40 deg. C. rise, which means that such a motor would be practically a continuous rated motor at 50 deg. C. rise.

Control for Multi-speed Motors: The control for multi-speed motors, particularly for those with 3 or 4 speed ratings or more, is very closely associated with the motor, and cannot easily be separated from the motor in making up a proposal for a new installation. In the case of the standard single squirrel induction motor, the matter of control is simplified and standardized to the extent that it need be given very little thought. Many manufacturers build that type of control, and practically all types are satisfactory.

In the case of the multi-speed motors, while the control

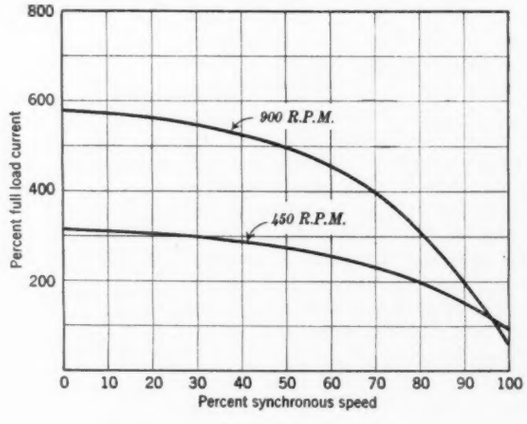


FIGURE 24

The chart above shows the current inrush characteristics for the same variable torque, variable horsepower motor as that discussed under Figure 23

has been standardized to a large extent, still care must be exercised in selecting the control, in order that it may properly provide for the proper connections and reconnections. The motor leads must also be brought out to correspond with the leads provided on the controller. Close attention must be paid to this, because the number of stator leads is in excess of those of the standard type of motor and can easily be confused. Not only this, but it will be impossible to secure the desired results from a motor designed to fit the need unless proper precautions are taken.

The Union Electric & Manufacturing Company of Milwaukee, Wis., has recently brought out a very complete line of drum type controllers for multi-speed motors.

Figure 26 shows an automatic accelerating panel for a two-speed separate winding, 2 or 3 phase, multi-speed motor, rated 50 hp., constant horsepower, operating a machine tool.

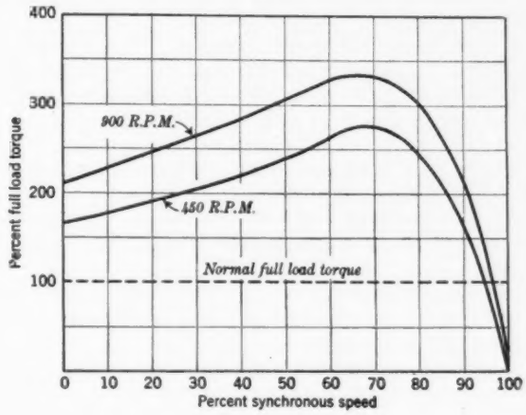


FIGURE 25

This chart illustrates the torque curves for the same variable torque, variable horsepower motor as that discussed under Figure 23

The current inrush is limited by means of resistance in the primary circuit.

Figure 27 shows a recent development of a standard multi-speed drum controller in connection with an automatically timed accelerating unit which is mounted on the bottom of the drum. The arrangement is such that starting resistance is used to limit the current inrush and this resistance is short circuited through the contact mechanism. An adjusting screw is provided for varying the time that the resistance is in the circuit, depending, of course, upon the load requirements of the motor. In operation this resistance is inserted in the circuit each time the motor speed is changed from low to high or high to low. This new development is important in that it entirely eliminates any chance of the controller not being completely synchronized with the resistance short-circuiting element, thus providing proper protection for motor and controller at all times. The resistance for this unit is separately mounted and not shown in the view.

Figure 28 shows a control unit designed for use with a

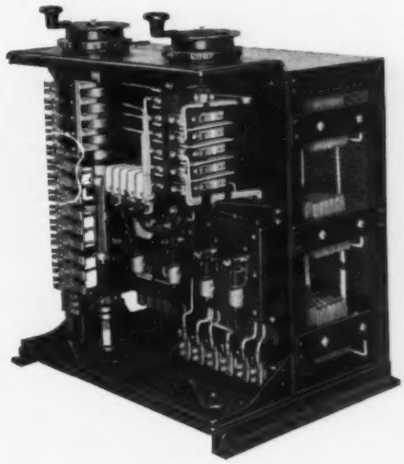


FIGURE 28

The illustration above shows a control unit designed for use with a slip-ring induction motor of the multi-speed type

slip ring induction motor of the multi-speed type. Primary or stator is of the pole changing type arranged to give two speeds from one winding. Secondary circuit consists of a 6-phase rotor which is regrouped to form a double 3-phase rotor at the high speed.

The drum shown at the right handles the rotor circuit of the motor as well as taking care of reversing the main line. The smaller drum at the left changes the primary from low to high speed. Beneath the drum can be seen the overload relays, two sets of which are provided, one for the high speed and one for the low speed. In the center between the drums is the main line contactor which opens an overload or low voltage. The resistance is mounted in the frame behind the controllers as can be seen.

The motor with which this controller is used although of

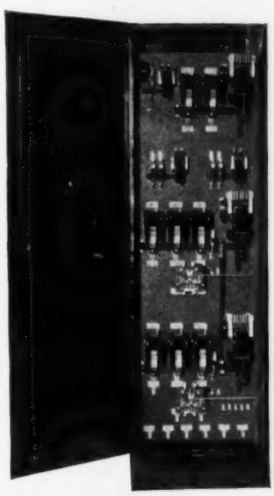


FIGURE 26

FIGURE 27

FIGURE 26, at the left, shows an automatic accelerating panel for a two-speed separate winding, 2 or 3 phase multi-speed motor, rated 50 hp., constant horsepower, operating a machine tool. The current inrush is limited by means of resistance in the primary circuit. Figure 27 shows a recent development of a standard multi-speed drum controller in connection with an automatically timed accelerating unit which is mounted on the bottom of the drum. The arrangement is such that starting resistance is used to limit the current inrush, and this resistance is short-circuited through the contact mechanism. Figure 29, at the right, shows an application of a special multi-speed controller and a vertical motor on a drill press

FIGURE 29

the slip ring type is essentially a multi-speed motor in that it is designed for two definite speeds which take care of practically its entire operating range. It is of the slip ring type to provide further variation in speed when necessary, for emergency operation or for some particular duty which lasts only a short time as compared to the normal operating period of the motor.

This controller is applied to various applications in the industrial field and particularly to applications in the oil well drilling field.

Figure 29 shows an application of a special multi-speed controller and vertical motor on a sensitive drill press.

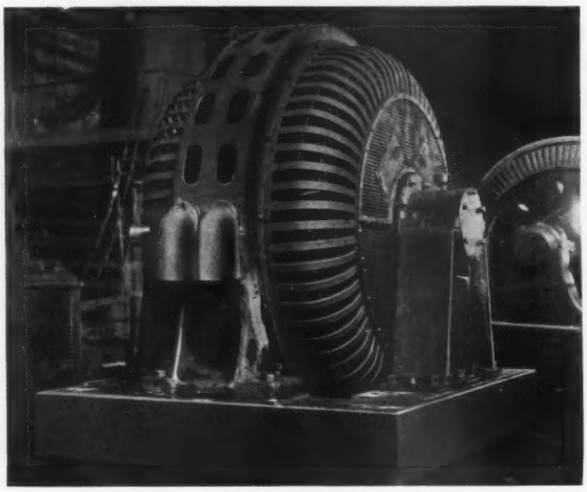


FIGURE 30

The illustration above shows a motor of the two pedestal bearing type with a base. It can be adapted for either direct or belt drive

The controller is shown with the front cover removed, exposing the terminal board to view. The operating shaft of the controller extends through the top of the frame and is operated through a set of double gears by the lever at the front of the drill press. The motor is a squirrel-cage motor of the multi-speed type, having two windings reconnectable for four speeds.

Below the controller is shown the main line contactor which provides overload and low voltage protection. This makes a very complete and well protected unit. This arrangement eliminates all belt shifting and speed changing gears and is very flexible and highly productive.

These controllers are complete in every respect and may be used with across the line type of starters or automatic compensators, giving complete automatic acceleration and control, or they may be used with manual control. Either type is provided with no voltage release and can be arranged for overload protection. Interlocks are usually provided to protect the motor from being thrown back on the line in case the overloads trip or the power fails, until the drum controller has been properly reset.

Due to the fact, referred to shortly before, that complications enter into control for a large number of reconnections, these drum controllers have been developed for only two types of multi-speed squirrel cage motors for general purpose applications.

The first type consists of control for motors having a separate and distinct winding for each speed. The second type was developed for motors of the consequent pole or pole changing type.

The first type, provided with separate windings, can, of course, be used for either two-phase or three-phase operation. The consequent pole type, however, requires so many lead connections for two-phase operation that the controller is considered too costly for commercial sale. It is recommended that the two-phase be converted to three-phase by the use of Scott connected transformers.

Assuming that the motor has been selected for a general purpose application having the proper torque and speed characteristics and that a drum type controller of the proper current and voltage ratings has also been selected; it is further necessary to have the exact information as to the internal motor connections and the external grouping of the leads to obtain each speed. A controller must be chosen which groups the leads exactly in accordance with the information given. It is, of course, essential that the control manufacturer and the motor manufacturer cooperate closely so as to make certain that the combined control and motor unit will provide satisfactorily for the customers' requirements. The plant manager need only specify his need; then the control and motor manufacturers make up their proposal to take care of his application, and guarantee the operation.

In addition to the drum controller, it is necessary as mentioned previously, to also include an automatic or manually operated starter. The automatic starter may consist of any of the three following types:

(a) The standard three-pole magnetic across the line type of starter, with low voltage protection or with combined low voltage and overload protection.

(b) The standard automatic resistance type of starter for squirrel cage motors equipped with proper protective features.

(c) The standard automatic compensator or auto-transformer type of starter for induction motors, also equipped with protective features.

In addition to the automatic starting feature complete semi-automatic control can be obtained by the addition of a pilot circuit attachment, to the bottom of the controller drum. This pilot circuit electrically interconnects the drum and the automatic starter. If the drum lever is moved, changing the motor connection, the pilot circuit automatically disconnects the motor, and then restarts the

FIGURE 31

This illustration shows a ball-bearing motor of the multi-speed type, which is rated as being highly efficient in operation

motor through the automatic starter. This is a particularly interesting control feature.

Low voltage protection is an inherent feature of these controllers. In addition contacts are provided in the drum controller so that a panel giving complete overload protection for each connection may be added if desired. By using these safeguards, the motor is positively protected.

The multi-speed drums may also be used with manually

operated starters. These starters may consist of either of two types.

(a) The hand-operated resistance starter.
(b) The hand-operated compensator or auto-transformer starter.

The interlock is also provided with manually operated drums to disconnect the motor, when the drum lever is moved for a speed change, but this does not provide automatic restarting. The operator must throw in the starting apparatus manually. Full protection can also be obtained with these controls—the low voltage protection being incorporated in the starter, and the overload protection being connected to the drum for each connection.

A mechanical interlock can also be provided, so that in the case of voltage failure, the controller must be returned to the "off" position before the relays can be reset. This compels the operator to start the motor correctly, and with the full protection for which the control is designed.

In explaining the control required for multi-speed motors, we have gone considerably into detail, in order that the reader may become conversant with the entire application. The development of this control for general purpose applications is rather new, and is very interesting.

As mentioned before, it would be possible to build the multi-speed motor in a very large number of speeds and winding combinations. To do so, however, would increase the complexity of the control, and increase the cost to the point where it would be prohibitive.

In general, as regards the cost of the control for the slip ring variable speed motor, which will be discussed in forthcoming issues of Electrical Manufacturing, and the cost of the control for a multi-speed motor, there would probably be little difference. In some cases, particularly, the more complex arrangements, consisting of

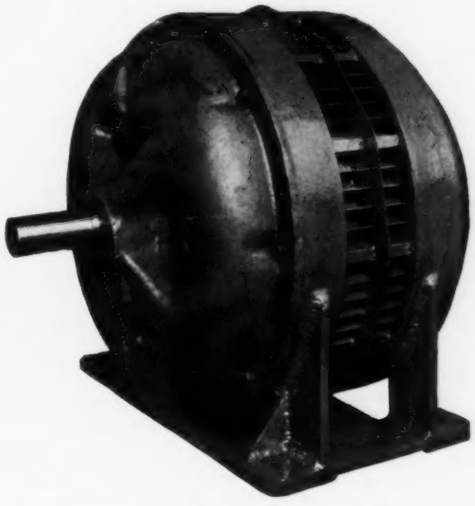


Figure 32

The illustration above shows a particular type of elevator multi-speed motor with the base or feet welded to the motor

complete automatic reduced voltage starters, combined with a drum controller arranged to give several reconnections, the cost would be somewhat in excess of that for the slip ring motor. Here again, the customer must weigh all the advantages and disadvantages of the two possibilities and decide whether or not the increased first cost will be warranted. Particular attention should be paid in making such an analysis, to characteristics that affect the power bill, such as efficiencies, and power factors, for, even a small monthly saving will soon outweigh any increased first cost, for a particular application. The torque characteristics, dependability, maintenance, and reliability of operation should also be considered.

In conclusion it may be interesting to the reader to notice how the variations in mechanical design particularly on the larger ratings are taken care of in the multi-speed motors. Figure 30 shows a motor of the two pedestal bearing type with a base. This type of mechanical design could be adapted for either direct coupling, or belt drive as the application might require. The construction used on this motor is particularly interesting as it indicates the increasing use of welded steel plate for bases and pedestals. Some motor manufacturers are using the welded construction for motor frames and other parts as well. It is generally conceded that the use of welded materials will displace the use of castings in time.

Figure 31 shows a ball-bearing motor of the multi-speed type. Here again the tendency of the motor-buying public, is seen in the demanding of ball-bearing motors, so as to obtain the best conditions for efficient operation and low maintenance costs.

Figure 32 shows one particular type of elevator multi-speed motor. The picture clearly shows the welded construction in fastening the feet to the motor frame. This motor was designed in an effort to bring the stator core as near to the outside frame surface as possible, so as to permit the use of a larger number of stator slots, the method used in producing quiet elevator motors. Note the provision for directed ventilation, the air being drawn in along the shaft and forced out around the stator.

Where and What the Aviation Market Is

(*Continued from page 24*)

Future demands of communication equipment for airplane use may be estimated in a general way from the following statements made in *Domestic Air News*, a weekly publication of the Department of Commerce:

"A new system of weather and communications service has been devised by which timely and accurate weather and landing conditions will be made available to any airplane, airport, landing field or individual caring to tune in. Any airplane equipped with a radio receiver will receive weather information at any point within the sector. The landing conditions at terminal and intermediate fields together with the short range forecasts are to be broadcast from all radio stations in a given sector once each hour on predetermined schedules. These reports will be followed by orders to pilots of airplanes in flight from the operation manager of the transport companies. The operation of large passenger airplanes makes it imperative that a more comprehensive weather and communications system be established. An adequate weather communications system should convey to the pilot enroute, the changes in weather and landing conditions, giving him reliable information as of the movement. It is, therefore, apparent that radio communication to aircraft is the solution of weather problems."

Radio beacons for guiding airplanes along their courses is another development of importance. The United States Bureau of Standards has developed a visual type of airway indicator which greatly simplifies the use of radio beacons. The use of this system for guiding fliers requires a radio receiving set on the plane and a transmitting station at the airfields at the beginning and end of the course, these two stations being not more than four hundred miles apart.

Facts, Figures and Trends

Statistical information of value to electrical manufacturers in working out policies and plans for production and marketing

New Market for Refrigerators

Electric refrigerators have recently made their appearance in Rumania, and although sales during the past summer were modest—some 60 machines sold in Bucharest—the results of these initial attempts are good and promise the development of the sale of this commodity in Rumania.

New Power Plant in Quebec

A new power plant with a capacity of 120,000 hp. will be constructed at High Falls, Quebec, for the James MacLaren Company at Buckingham, Quebec. When this is completed a 25,000,000 cu. ft. storage reservoir will be built at Cedar Rapids. The work will involve an estimated expenditure of $12,500,000.

Russia Plans Extensive Manufacturing Program

It is reported that, according to the present program, the production of electrical equipment in Russia for the fiscal year 1928 to 1929 will be 36 per cent higher than that in the year which is just closing. It is said that the Russian electrical industry will go in more intensively for the production of cables, storage batteries and radio apparatus.

First All-Electric Hotel in Australia

The Yallourn Hotel, at Yallourn, Gippsland, in southeastern Victoria, was opened as the first all-electric hotel in Australia. This hotel is operated by the Victorian State Electricity Commission at the Commission's central power undertaking for the State of Victoria. Each room is fitted with bath facilities, for which the water is electrically heated, together with electric shaving mirrors, which are oval in shape, with the electric light in the center to warm the glass and dispel the condensation of steam from the hot water. All of the kitchen appliances, such as egg beaters, cake mixers, stoves for cooking, etc., are run entirely by electricity, and the hotel is also heated by electricity.

Electric Light and Power in the Philippines

Recent Department of Commerce reports state that there are at present, according to the best available records, approximately 100 electric power and light companies in the Philippine Islands. Of these, 67 are privately owned and operated, 15 are owned and operated by provincial governments, and 19 are owned and operated by municipalities, in addition to which there are 29 uncompleted projects. The standards of electric service, except in the cities of Manila, Cebu, and Iloilo, are comparable with those existing in the industry in this country before 1900, the entire installed capacity to serve the islands population of 12,000,000 persons being less than the load requirement of the average city in the United States having a population of 50,000.

Sources of Foreign Credit Information

Trade Information Bulletin No. 292 (Revised), entitled "Sources of Foreign Credit Information," compiled by A. S. Hillyer, chief of the Commercial Intelligence Division of the Bureau of Foreign and Domestic Commerce, has been issued. This pamphlet may be purchased (price 10 cents) from either the district offices of the Bureau or the Superintendent of Documents, Government Printing Office, Washington, D. C.

Market for Electrical Appliances in Mexico

The power company in Aguascalientes, Mexico, has recently been taken over by a large company with American capital and is acquiring power plants in various places in Mexico. This was formerly a German organization, equipped with German machinery, and its electrical appliances were almost entirely of German manufacture. A special exhibition and sales room has been opened, and the sales responses have already been encouraging. It is thought that this will offer a good opportunity for American manufacturers of electrical appliances.

Market for Electrical Appliances in New Zealand

The market for American electrical household labor-saving appliances continues strong. Electric refrigerators, irons, stoves, washing machines and vacuum cleaners are all having good sales, and although competition is keen, the excellent quality of the American products, combined with intensive merchandising, is keeping them ahead of the Swedish, British and Canadian electrical appliances.

Electric Irons in Brazil

There is a good demand for electric irons in Brazil, especially since little washing is done by laundries equipped with modern ironing machinery. The few laundries find that hand labor is more economical than machinery; the latter is little used. Practically all tailors use electric irons for pressing clothes, and of the number of cleaning and dyeing establishments, it is estimated that less than one-fourth have pressing machines.

Connecticut River Power Project

Work has been started on a 250,000-hp. development, costing $40,000,000, in the Connecticut River at Monroe and Littleton, N. H., and Barnet and Waterford, Vt., permission for which has recently been granted. Highways are being widened and tracks laid to rush material in to the sites of the two dams, one of which will be 165 ft. long. The construction work is expected to give employment to 4000 men for three years. When completed, the dams will hold back upward of 7,000,000,000 cu. ft. of water, creating lakes which will be the largest in the East.

Exports to Canada

Canada, with a total population of only about 9,389,000—about the same as that of the metropolitan district of the city of New York—in the first half of this year purchased American merchandise amounting to $429,199,000, or 18.1 per cent of our total exports, thus becoming by far our most important market, having outdistanced the United Kingdom by nearly $45,000,000. Exports to our northern neighbor were 6.4 per cent greater than a year ago.

American Copper Output Leads the World

The increasingly important part played by the United States in supplying the world with copper is shown in an economic study of the production of copper during the nineteenth and twentieth centuries, which has just been completed by the Bureau of Mines, Department of Commerce. Since 1800 the United States has produced more than 19,500,000 tons, or 48 per cent of the world's output.

Market for Lighting Fixtures in Argentina

The demand for electric current in Argentina has been growing rapidly during the past few years, due principally to the increasing use of electric motors in industry and the more widespread demand for electricity for lighting purposes. In the Buenos Aires district the increasing need for electricity is particularly noticeable. It has been estimated that out of a total of about 1,400,000 homes in the entire country, about 550,000 are wired for electric service. When the number of unwired homes is considered, and also that many of the wired homes are inadequately wired and still retain, in many cases, fixtures of antique design and inferior quality which must sooner or later be replaced, it may be seen that the potential demand is a reasonably large one.

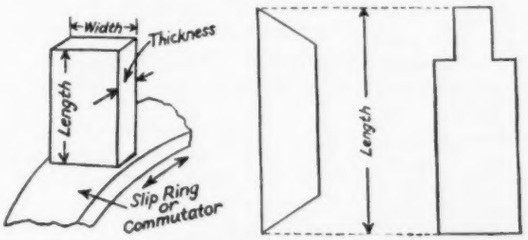
The Advantages of Standardizing

Brushes and *Shunts*

The standardization of carbon brushes and brush shunts is bringing about reduced inventory investment and simplification of production problems

THE development of the electrical art, in so far as it is applied to the design and construction of motors, generators and dynamos, has been eminently satisfactory because of the vast amount of experimentation that has been carried on with many types and sizes of equipment. The present large variety of carbon brushes and brush shunts is a natural consequence of that experimentation, and while it is still a difficult matter to determine which sizes and dimensions should survive and which should be discarded, it is reasonable to suppose that a great many special varieties could be conveniently eliminated.

Present-day automobiles and trucks carry motors, generators and self-starters that are equipped with many different sizes of carbon brushes, and the cost of this wide variety is borne first by the dealers and service stations and eventually by car owners. On shipboard it is necessary to carry a complete line of spare carbon brushes for every commutator and slip ring installed. This provision must be made as an assurance against expensive delays in foreign ports. Automotive and marine engineers have expressed the need for a less complex system of brush sizes.



The length of a brush is the maximum over-all dimension in the direction in which the brush feeds to the commutator or collector ring. The width of a brush is the dimension at right angles to the length and to the direction of rotation. The thickness of a brush is the dimension at right angles to the length in the direction of rotation

NOTE.—In the case of wedge-shaped brushes for radial-faced commutators there are two thicknesses.

Manufacturers of carbon brushes and brush shunts have long realized that they are spreading their production and investment over a range of sizes that are legion in number. The distributors of brushes have had to invest appreciable sums of money in stocking their shelves to meet every possible demand, when the bulk of normal requirements could be adequately satisfied with fewer variations in sizes and dimensions. The consequent confusion of choice has affected the manufacturers of brush holders, which is an item of considerable importance in the design of motors and generators destined for a myriad number of uses. Whenever a new size of brush has appeared on the market, the manufacturers of brush holders have had to increase the variety of their product, while the producers of brushes have found themselves similarly influenced by the ever-growing list of holder sizes. Each of these groups has been working out its own destiny without regard for the obvious advantages that would result from a mutual plan of development. With both groups adhering to a common guide, all interests would be served.

During its ten years of research the Electric Power Club, now a part of the National Electrical Manufacturers Association, made no attempt to establish a fixed number of definite sizes, shapes and dimensions of carbon brushes. Instead, that organization endeavored to determine which are the reasonable size limits within which one dimension might vary in respect to the other fixed dimensions. In thus systematizing the design of brushes the tendency has been to discourage the continuance of odd and special sizes without in the slightest degree hampering the development of better brushes or more efficient motors.

Dimensions for Brushes (Plain and Plated)

Table 1—Lengths of Round and Rectangular Brushes (in inches)				Table 2—Width (in inches)			
¼	9/16	1	2¼	⅛	⅜	1⅛	1⅞
5/16	⅝	1⅛	2½	5/32	7/16	1¼	2
⅜	11/16	1½	2¾	3/16	½	1⅜	2¼
7/16	¾	1¾	3	7/32	⅝	1½	2½
½	⅞	2	3½	¼	¾	1⅝	2¾
				5/16	1	1¾	...

Table 2a—Diameter (in inches)		Table 3—Thickness (in inches)		
⅛	5/16	1/16	5/16	⅞
5/32	⅜	⅛	⅜	1
3/16	7/16	5/32	7/16	1⅛
7/32	½	3/16	½	1¼
¼	...	7/32	⅝	1⅜
		¼	¾	1½
		5/32		1¾

Upon the request of the Electric Power Club, the division of simplified practice of the Department of Commerce invited representative manufacturers, distributors and users of carbon brushes to convene in Washington and discuss the tentative simplified practice recommendation proposed by the Electric Power Club.

Except for one or two minor changes the recommendation was approved as originally submitted, it being the opinion of the conference that any extensive modification had best be deferred until the first revision conference, in 1927, under the auspices of the division of simplified practice.

As a means of obviating misunderstandings between buyer and seller, the conference amplified the recommendation to include definitions of "length," "thickness" and "width."

In accordance with the unanimous action of the general conference of representative manufacturers, distributors and

users of carbon brushes and brush shunts, held on April 14, 1926, and the revision conference of Sept. 29, 1927, the industry adopted and approved for promulgation by the United States Department of Commerce a simplified practice recommendation establishing a schedule of sizes and dimensions for stock items of carbon brushes and brush shunts. These various sizes and dimensions are shown in the accompanying illustrations and tables.

For indicating the size of a brush the dimensions shall be given in the following order: Length, width, thickness.

Table 4.—Tolerances

(a) Rectangular and Square Brushes:

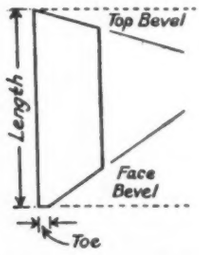
1. *Carbon and graphite brushes—*
   Length.—Plus or minus 1/32 inch.
   Width.—Plus 0.000 inch minus 1/64 inch.
   Thickness:
   Thickness and width up to and including ¼ inch plus 0.000 inch, minus 0.003 inch.
   Thickness greater than ¼ inch.
   (Plain) plus 0.001 inch, minus 0.003 inch.
   (Plated) plus 0.001 inch, minus 0.004. (To be measured over metal coating.)
2. *Metal graphite brushes—*
   Length—Plus or minus 1/32 inch.
   Width.—Minus 0.007 inch to minus 0.020 inch.
   Thickness.—Minus .007 inch to minus 0.011 inch.

NOTE.—For square brushes thickness limits apply to both width and thickness.

(b) Round Brushes:

Size	Plain Brushes (*inch*)	Plated Brushes (*inch*)	Length of ring gauge (*inch*)
Up to ¼ in., incl.	+0.000, —0.002	+0.000, —0.006	½
Over ¼ to ⅜ in., incl.	+0.000, —0.004	+0.000, —0.008	⅝
Over ⅜ in.	+0.000, —0.006	+0.000, —0.010	¾

Table 5.—Bevels on Brushes



(*a*) The bevel angle shall be specified as the angle included between the bevel face of the brush and a plane at right angles to the length of the brush.

(*b*) Face bevels on brushes shall be limited to a minimum of 15 deg. and a maximum of 35 deg., varying in steps of 5 deg., and shall be accurate to within 1 deg. above or below. Top bevels shall be 15, 30 or 45 deg.

(*c*) The length of a beveled brush shall be the distance from the square end to the toe of the bevel, if beveled on one end only, or the distance from toe to toe measured parallel to the side of the brush when both ends are beveled. In other words, the length shall be that of the square-ended brush from which the beveled brush was made.

(*d*) The width of the toe of beveled brushes shall be:

Brush thickness	Width of toe
Up to 1 inch, inclusive	⅛ of brush thickness
Over 1 inch	⅛ inch.

Tolerances plus or minus 1/32 inch.

Table 6.—Chamfer on Brushes

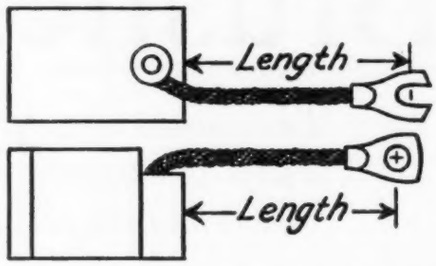
(*a*) The angle of chamfer shall be such that an equal amount of material is taken from the two adjacent surfaces. On square or rectangular brushes the angle between the plane of the side of the brush and the plane of the face of the chamfer extended shall be 45 deg. as measured with a protractor.

(*b*) The depth of chamfer on each surface shall be measured along the plane on each of the two adjacent surfaces and not the width of the face of the cut portion. The standard depth of chamfer which is to be given to different sizes of brushes shall be as follows:

Thickness of brush (for any width)	Depth of chamfer (inch)
¼ inch or less	1/64
Over ¼ inch, but less than ⅜ inch	1/32
⅜ to ⅝ inch, inclusive	1/16
Over ⅝ inch	3/32

Tolerances plus or minus 1/64 inch.

Table 7.—Shunts (flexible) for Brushes



(*a*) Length.—For the purpose of measuring the length of the shunt the cable shall be extended upward away from the face end of the brush in a line parallel to the lengthwise corners of the brush. The length of the flexible shunt will be the distance from the extreme top of the brush to the center of the hole or round portion of the slot in the terminal or to the center of the inserted portion of the plug terminal. Except for automotive brushes or fractional horsepower motor brushes, standard lengths of shunts for brushes one-half inch wide or over increase by inches from 2½ to 7½ inclusive.

Tolerances on length—plus ¼ inch minus 0.000 inch.

(*b*) Cable sizes.—Standard sizes of and specifications for cable for brush shunts shall be:

Number of Strands	Conductors per Strand	Diameter of Wires	Circular Mils	Nearest Size B. & S.
		Inch		
1	33	0.002	135	29
1	33	.003	300	25
2	33	.003	600	22
7	15	.003	1,038	20
7	9	.005	1,575	18
7	15	.005	2,625	16
7	24	.005	4,200	14
7	37	.005	6,475	12
7	59	.005	10,325	10
7	75	.005	13,125	9
7	95	.005	16,625	8
7	119	.005	20,825	7
7	150	.005	26,250	6

Table 8.—Terminals for Flexible Shunts

The diameter of hole or width of slot in terminal shall be as follows:

Size of Screw	Maximum Size Hole or Slot (inch)
No. 6	5/32
No. 8 and No. 10	7/32
No. 12 and No. 14	9/32
5/16-inch diameter	11/32
3/8-inch diameter	13/32

Tolerance limits, plus 0.000 inch, minus 0.010 inch.

This recommendation has been effective since June 15, 1928, subject to regular annual revision by a conference of the standing committee.

While not restricting combinations of dimensions, the revision represents the first step toward concentration on a limited number of sizes. Those responsible for initiating this program, and those who are supporting it, wish to have an answer for the question—What has been accomplished by the application of this simplified practice during its effective period which began Nov. 1, 1926?

In October, 1928, a letter was addressed to all manufacturers, distributors and users of carbon brushes, who had accepted the recommendation, asking that they review their experience with it, with a view to determining its benefits in dollars and cents. A total of 218 letters were sent out. Replies received numbered 91, of which 6 were from manufacturers of brushes; 8 from distributors; 25 from public utilities; 22 from builders of motors and generators, and 30 from other users.

From the viewpoint of possible benefits derived, the degree of adherence accorded the recommendation by industry

(*Continued on page* 68)

Important Factors to Observe in the

DESIGN of Motor Shafts

Designing shafts for efficient production with the machine tool equipment available is a difficult problem confronting all electric motor builders

By R. Kraus

Motor Engineer, Westinghouse Electric & Manufacturing Company

THE attention given to the mechanical design of a motor should be also fully extended to the problem of adapting the shaft design to the method of production of the shaft with the equipment at hand, as not only its own cost is influenced, but also the cost of the rotor assembly. The various shaft features affecting the production can be studied best on a shaft of medium size, as in the lower portion of Figure 1. Such a shaft would be manufactured in an engine lathe. The shaft mentioned belongs to a wound rotor shown at the top of the same illustration.

A short description of the shaft will be helpful to follow the trend of the reasoning. The shoulder at A (Figure 1) is necessary between the shaft extension (3⅞-in. diameter) and the rear bearing seat (4-in. diameter). The shoulder at B serves as bearing thrust; its diameter being set by the bearing diameter. The diameter (5.253 in.) at the rotor seat, governed by the deflection, was responsible for the shoulder at C. The slight reduction from 5.253-in. diameter to 5.247-in diameter between C and D assists in the pressing on of the rotor. The thrust shoulder at G is required for the front bearing; the reduction of the collector seat of 4.560-in. diameter to 4.555-in diameter between F and G facilitates the pressing on of the collector; while the shoulder at E is due to the difference of bores of hubs of the collector and the rotor.

The reasons for these various shoulders have been explained because each one of them adds to the cost of the shaft. The diameter at the rotor seat requires shaft stock which makes it possible to have the oil-throwers as an integral part of the shaft.

The following machining operations are necessary for completion of the shaft considered:

1. Cutting off the shaft stock.
2. Centering.
3. Heat treatment when specified.
4. Rough turning.
5. Spotting and recessing at fillets.
6. Milling of Keyways.
7. Grinding.
8. Filing and polishing.

The scope of each operation must be clearly understood in order to adapt the design to the machine tools available, serviced by an average operator; the design must require in its inception not only the fewest number of different machining operations, but also make it possible to give preference to machining operations of lower cost, if the same end can be accomplished.

THERE are many difficult problems to be considered in the design of a shaft for an electric motor, and probably that of most importance is the type of equipment available for the making of the shaft. In this respect careful consideration must be given to allowances for machining and assembling after completion, if the shaft is to be produced at low cost. In this respect every step in the process must be planned, from the size of the raw material to that of the finished product.

THE EDITOR

For the first operation, the cutting off of the shaft stock, is specified. An allowance of 1/16 up to ¼ in. is made on the diameter for machining, depending on the diameter and the length of the shaft. The length influences this allowance because the material as received from the mill is not perfectly straight and warping will occur. This makes it necessary to increase the allowance for heat-treated shafts, in order to avoid the scrapping of shafts partly finished, because they might show unfinished spots at bearing seats or exposed parts of shaft where they could not be permitted.

An increase in the shaft stock does not necessarily bring about a proportionate increase in labor cost for removal of the surplus material, because with the tool steel of today cuts can be taken which will reduce the diameter 1⅜ in. in one operation, two cutting tools, opposite each other, being used for such cuts on shafts up to 5-ft. long.

The cutting off as well as the centering may be done in the stockroom. An allowance of at least 1/16 in. is provided by the stockroom at each end for facing after the shaft has been roughed and spotted. The allowance is, of course, not closely maintained, but the stockroom should increase the depth of the counterbore by any excess that was added to the length of stock. If the counterbore is not deep enough it will disappear at the facing and leave the centers unprotected, but if the counterbore is too deep, then the centers rest on the outer edge of the counterbore which results in an unsatisfactorily finished shaft.

Rough turning is the first machining operation on the shaft. It is a reduction of the material along the shaft stock to such dimensions as to permit finish by grinding to the final size. As the driving dog of the lathe is applied to the shaft at the head stock, which is the left end, the removal of the material by rough turn starts from right to left toward the shoulders. This permits the tool to travel as near to the shoulders as is expedient for the work, cutting down to the smallest diameter at the shaft end at which the machining started, then progressing with the machining until the largest diameter is reached. The shaft is then reversed in the lathe centers for finishing of the remainder of the work. This is accomplished by removal of the material toward the shoulders from right to left as before. During the roughing an allowance is made for machining of fillets and the final location of the shoulders.

Bearing in mind the method described for roughing and the necessity of an allowance at each shoulder for final finishing it becomes apparent why the shop scales in total dimensions from the shaft end at the right shaft center to each shoulder and not from shoulder to shoulder, otherwise the inaccuracies of the allowances would add up at each step, making it uncertain if the final shoulders could be machined at the right location. Incidentally, a casual error in one step would throw out every successive shoulder, making the final finish impossible.

The requirements of the shop as outlined in the foregoing are taken care of, as shown in Figure 1. Overall dimensions are shown from right shaft end to each essential shoulder up to and including the largest diameter. After that overall dimensions are recorded from the left shaft end to the remaining shoulders, in line with the explanation of the reversal of the shaft in the lathe centers during the roughing. The space above the shaft centerline is preferably used for these and all other axial shop dimensions arranged in sequence of their use while below the shaft centerline a record is kept of the various vertical centerlines to which the drafting room has to refer.

By adapting the drawing to the shop processes, unnecessary shoulders will be eliminated, thereby lowering the cost of the grinding. Also time is saved for the lathe operator and the inspector or foreman, as so-called shop dimensions do not have to be calculated in the shop and recorded on a shop blueprint which requires frequent replacement. This process must be repeated every time a print is worn out.

As may be seen from Figure 1 the roughing dimensions do not go to every shoulder, because it is left to the grinding operations to produce shoulders between such diameters as at D, Figure 1, which have only a difference of 40 to 45 thousandths of an inch.

The shaft stock may happen to be too short to finish to the full length expected, because the saw did not cut the ends perfectly square. This shortage is taken up at the end, where it is of no consequence. For example, in a shaft with a straight extension, as at A, Figure 1, the variation is taken up at the front bearing end as indicated at F, in Figure 1, because such a shaft may be used with a coupling in some applications, which must be accurately located relative to the vertical centerline of the machine.

Shafts with tapered extensions used for railway or mill motors do not present much difficulty in case of a variation in length of the shaft stock, because one or both ends have threaded stubs for lock nuts to hold the pinion or brake drum in place. These stubs are usually slightly longer than the thickness of the nut and take up any reasonable shortage. For such shafts the relative location of the bearing thrust shoulders and also the location of the tapered fits must be maintained.

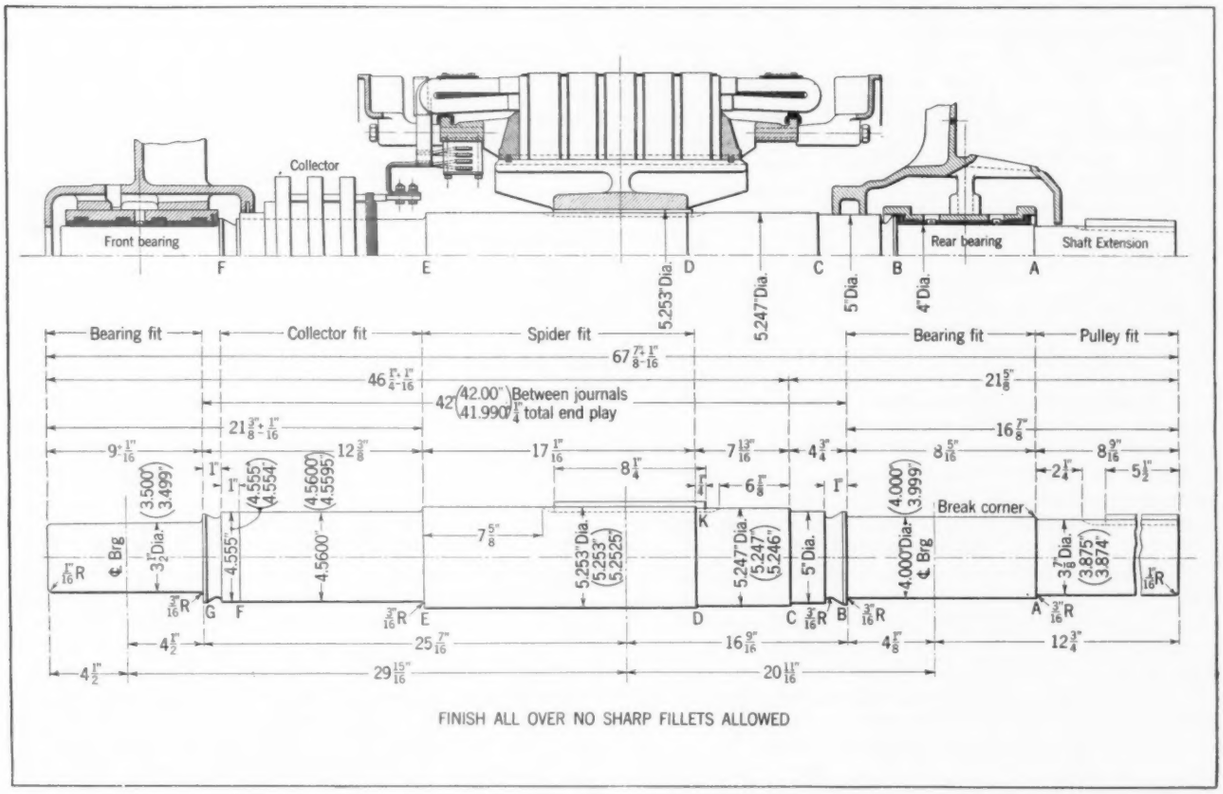


Figure 1 illustrates the proper method of dimensioning a shaft and the same shaft shown as assembled. Notice that dimensions to the various shoulders are given from the two opposite ends of the shaft. This is due to the fact that there is no definite relation between the two ends and compensates for any errors that might arise in the overall dimension. It also simplifies production

The rough turning is followed by the spotting of the shaft. In this operation the respective shoulders are accurately located and any remaining material which cannot be removed by grinding operation is cut away. The location of the shoulders includes the machining of the oil throwers as at B and of all fillets as at C.

The oil throwers are machined with a tool suitably ground. Figure 1 shows the 3/16-in. fillet required at the thrust shoulders, and used at all shoulders of the shaft and with one fillet size only. One fillet tool is necessary. When the difference of adjacent diameters is so great that the permissible fillet stresses would be exceeded, a larger fillet must be used, requiring, of course, the handling of an additional fillet tool.

Special form cutters for the oil throwers, so arranged as to machine at the same the grooves and the fillets at the bearing thrust shoulder may be used, but their efficiency is questionable because their maintenance is expensive and in addition, it is necessary to take a finishing cut off the thrust shoulders to insure accuracy and smoothness.

While the shaft is being spotted it is also recessed at the fillets as shown at K in Figure 1. This facilitates grinding because the edge of the grinding wheel can extend beyond the straight part of the shaft as indicated without danger of damaging the fillets. As this recessing amounts to only 10 to 15 thousandths of an inch on the diameter and the intended fillets are maintained, there is no appreciable increase of shaft stress. The shaft ends are faced before the shaft is removed from the lathe.

The next operation is that of milling the keyways, the depth is so arranged as to take care of the allowance to be removed by grinding. All the keys in the shaft, Figure 1, can be milled on a horizontal milling machine, an advantage for shafts produced in quantity, because it enables multiple milling. Two or four shafts can be clamped

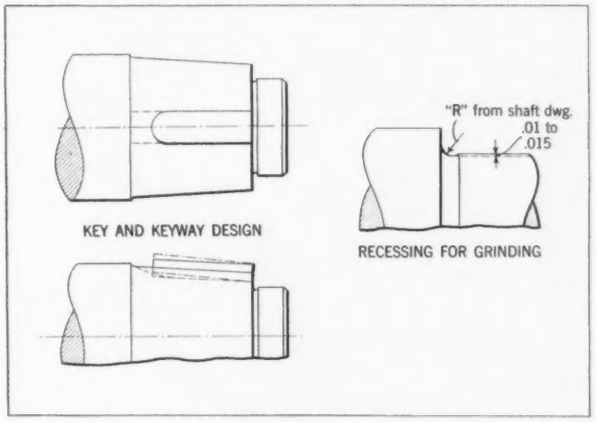


Figure 2 illustrates the methods of dimensioning keyways in motor shafts and at the same time shows the type of key best suited for this purpose. Notice the small recess for the grinding operation

in the V-blocks and all settings are made once only. All duplicate shafts need only be clamped in the V-blocks to insure accuracy of keyways when the milling operation is completed. The keyways are cut absolutely square and parallel to the shaft centerline, because the V-blocks used with the milling machine have been milled by the milling machine itself. Notice might be taken as to how the keyways have been dimensioned in their axial location. See Figure 1 at K. The operator need only centerpunch the ends of the keyways and proceed with the milling without any figuring. If possible, keys of the same width should be used for one shaft, because that eliminates changing the cutters. A difference in depth can be readily taken care of by raising or lowering of the table.

Shafts with tapered extensions have preferably profiled keyways, because these eliminate any possibility that the pinion hub, etc., might wedge on the key instead of on the tapered fit as might be the case where the keyway terminated as shown in Figure 1.

The shaft is now ready for grinding. Seats for rotors may be rough ground. This is not as fine as the "finish grind" of exposed parts of the shaft and of the journals.

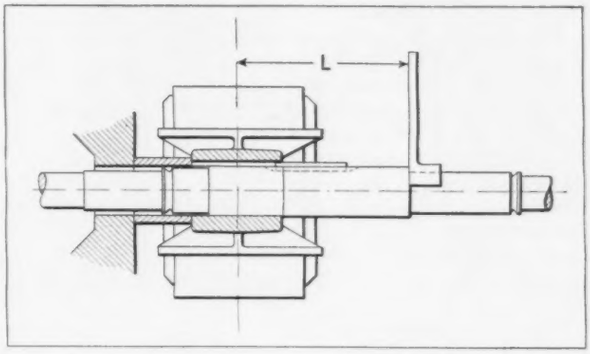


Figure 3 shows the manner of assembling a shaft when a gage is employed to locate the shaft properly. Without locating the shoulders on the shaft accurately at the time of designing it, this practice could not well be followed

Diameters rough ground cannot ordinarily be held within a tolerance of a half thousandth of an inch. A minimum tolerance of .001 in. should be permitted. When small and medium size shafts were also finished by means of a finishing cut, it was essential to limit the length of those parts of the shaft, which had to have close limits. When the grinding process is used it is advantageous to eliminate repeated setting for grinding, hence there should be as few shoulders as possible, or expressed differently, as few different diameters as possible. Figure 1 shows a design where shoulders have been eliminated as far as possible, which is economical for grinding. The length of the rotor seat has been increased so that it becomes adjacent to the collector seat thus eliminating one shoulder at B. For the same reason the diameter of oil-thrower at the right end is carried through to the rotor seat, saving another setting of the grinding wheel.

Filing and polishing is the final operation. The filing removes all burrs and breaks the sharp corners at shoulders. The shoulder between the extension and the journal is particularly important, because any damage of the bearing babbitt must be prevented when the bracket is being mounted on the shaft.

If recessing at fillets as described in a preceding paragraph is not practiced the additional operation of polishing to render the various fillets smooth is necessary. The recessing method, however, is more desirable.

As stated at the outset the various operations discussed applied to a shaft made on an engine lathe. When a minimum of 30 to 60 shafts of one size is to be produced, semi-automatic machines offer an economy. This requires a set up of tools, depending on the number of shoulders.

It is desirable to avoid having the length of any one section of the shaft too short; the minimum length being largely determined by the space occupied by one tool holder. The location of shoulder at C, Figure 1, could be moved toward D if necessary.

The expense of set-up can be spread over several groups of shafts, if their only difference is in the length of the rotor seat. The relative set-up of each group of tools on either side of the rotor seat is not disturbed as these groups are on different machines, it taking two machines for the machining of one shaft prior to grinding; the

rotor seat is worked on by both machines in order to reduce the total turning time, which is governed by the longest cut.

The shaft at the top of Figure 5 shows diagrammatically a shaft similar to the one in Figure 1, though smaller. The next shaft in Figure 5 belongs to a motor using the same brackets as the motor with the shaft at the top of Figure 5, but the core width is different. For such shafts it is essential that parts marked with the same letters are kept absolutely alike.

The two shafts at the bottom of Figure 5 show diagrams of set-ups; the tools are shown in their respective positions at the completion of the operation; the dotted lines indicate where the rough stock has been removed. The first operation roughs from the shaft extension up to and including part of the rotor seat. The shaft is then transferred to the second machine which finishes the remainder of the roughing and also does the spotting and cutting of the oil-throwers. For this latter machine, tools for roughing are shown on one side, the tools for spotting and cutting of oil-throwers on the other side of the centers.

The cost reduction of the set-up, by manufacturing groups of similar shafts in rotation, is worth while, particularly as it can be had without any hardship on the design, in fact, there is no reason why the dimensions of the shaft parts marked with the same letters as in Figure 5 should be different, after satisfactory proportions have been arrived at.

The shafts considered had oil-throwers turned in as part of the shaft. When the diameter of the rotor seat is of such a proportion to the bearing diameter that sufficient area of thrust shoulder at the bearing cannot be obtained from the shaft stock used, then separate oil-throwers are necessary. Cold-rolled steel is a desirable material for them because it is more readily machined than hot-rolled steel. Figure 4 shows separate oil-throwers at A.

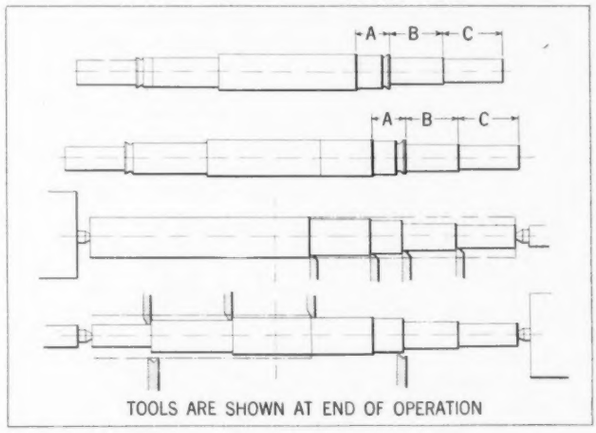
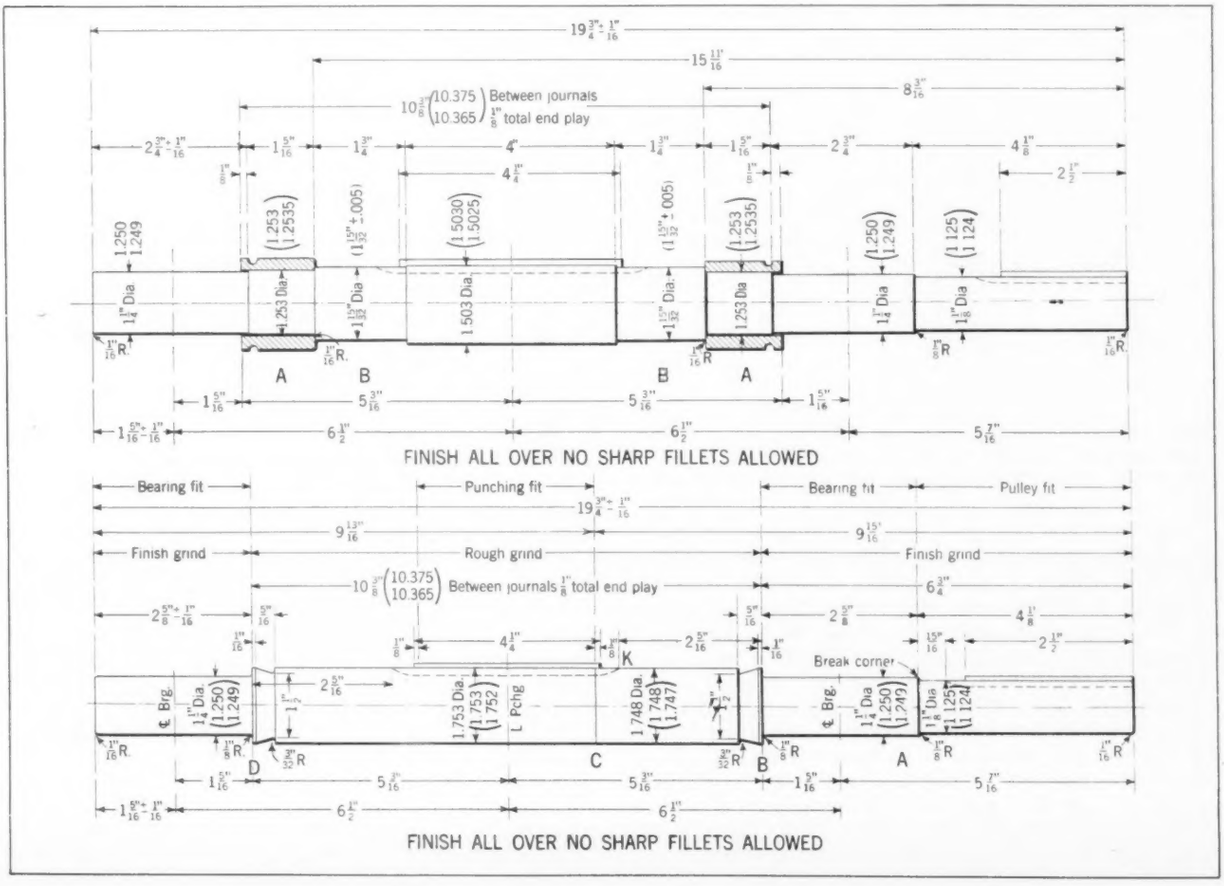


Figure 5 shows the relative positions of shoulders on different types of shafts and at the same time illustrates how machine tools are arranged in groups for the rough and finish operations in quantity production. Separate tools form the oil slinger

The assembly of parts on the shaft can be facilitated in the design without any appreciable increase in the cost of the shaft. The pressing on of the rotor, collector or commutator to the shaft is common to most of the shafts considered. In order that such parts should not have to be pressed over shaft sections of the same diameter, where

Figure 4. Here again are shown two other types motor shafts having distinctive types of oil slingers. Notice, too, the proportions of the different shafts, which is a very important feature of their design, the lower of the two being the better



There *IS* a difference in mica.

All commercial mica is not the same, and the many different uses to which it is put demand different and very definite qualities.

In some instances a very high insulating point is required, others demand uniformity of thickness, others require heat-resisting qualities along with insulation effectiveness. And so on.

We have, during our many years experience, met those problems successfully, not once, but many times. The information we have gleaned may be of great value to any user of commercial mica, but it does not add to the cost of Macallen Mica.

Tell us of your problems. Our advice does not obligate you in the least.

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they are not seated, such shaft sections are reduced by a few thousandths. This is called a "draw" or "lead." It helps to center the hub of collector or rotor core on the shaft and eliminates any appreciable shoulder, against which the hub would tend to bind. Keys are extended about ¼ in. in this "draw" so that they may start in the keyway before the "pressing-on" starts. In the interest of eliminating as many shoulders as possible, it will not ordinarily be necessary to provide a "draw" at both ends from punching fit as shown in Figure 4 at B. One "draw" will be sufficient and as the press for pressing on the machine part involved is preferably applied to the end of the shaft nearest the fit for the part, to avoid buckling of the shaft under the tonnage required to move the part into position, the "draw" should be located at the end of the corresponding fit farthest from an end of the shaft, in other words, at the "long" end of the shaft. Figure 3 shows a rotor showing the press and also how a gage is straddling the shaft to measure from a shaft shoulder to the centerline of the core.

Slender shafts with separate oil-throwers are more subject to buckling. Actual shafts as shown at the top in Figure 4 require straightening after the rotor is on the shaft, while experience with the revised shaft as shown at the bottom of Figure 4 was so favorable that the percentage of bent shafts was negligible.

An excess amount of press-fit is frequently responsible for bent shafts; built up cores are subject to some irregularity in the bore, which will spring a shaft. These irregularities in the bore will increase with the length of the core, and with it more pressure is required to press the shaft into the core. Of course, this increased pressure will be responsible for an additional tendency toward bending. To avoid this, the press-fit may be reduced for longer cores of the same bore, below that used for shorter cores. Machinery steel shafts that have been bent only a few thousandths can be straightened, however, with heat-treated shafts this is more difficult on account of the increased strength and toughness of the material.

The conclusion that can be drawn from the preceding will not only justify the statement made at the outset that the shaft design from the standpoint of production requires serious attention, but it proves the problem is very intricate.

Advantages of Standardizing Brushes and Shunts

(*Continued from page 62*)

is of primary importance. Although an actual survey of production has not yet been made, the attitude of the manufacturers indicates that the simplified schedule is being adhered to wherever there is offered any freedom of choice.

The public utilities companies, replying as users, have, in the main, experienced no monetary benefit as yet. However, it is significant of their interest and faith in simplified practice that the majority look forward to such benefits as prompter delivery, reduction of replacement stocks, and the like.

A study of the replies indicates that the smaller manufacturers are in an equally favorable position with their larger competitors, so far as regards the potential benefits of the program.

The most general opinion set forth in the replies is that it is too early to expect important savings. This, it is pointed out, is due to the fact that a great portion of brush sales consists of items for the maintenance of present equipment which, of course, includes, together with more modern motors and generators, much that is old and nearly obsolete, but still serviceable. In the opinion of some, it will be five years before the gradual obsolescence of machines using odd sizes of brushes, and absorption of new designs using only the simplified types, will effect a sufficient change in the market to allow the realization of such benefits as reduced inventory investment, simplification of production, and so forth, on any large scale.

What Equipment Electrical Manufacturers Buy

(*Continued from page 30*)

Bearings are another important factor in the use of electric motors and it would seem from reference to Figure 5 that, while the sleeve bearing is the oldest in general use, it is still favored over the other two types. In answer to the questions pertaining to bearings many electrical manufacturers indicated that they used all three types, while some of them purchased bearings of any type to suit the needs of the purchaser of their product. At any rate, while there is some overlapping of the reports in this chart it is evident that 38 use ball bearings exclusively; one manufacturer reports as using roller bearings only and 85 employ the plain or sleeve bearing. Other data in the chart give the combined uses of all three types.

In conclusion it might be pointed out that while this survey includes only representative groups of electrical manufacturers and not the entire industry it is clearly evident that there is a potential annual market in the industry for upward of 800,000 electric motors, 1,600,000 bearings of different types, 800,000 drives and 800,000 connections, to say nothing of the vast amount of other electrical material in as much as practically every motor must be equipped with some form of control, switch or electrical fittings, such as conduit, connections and wire.

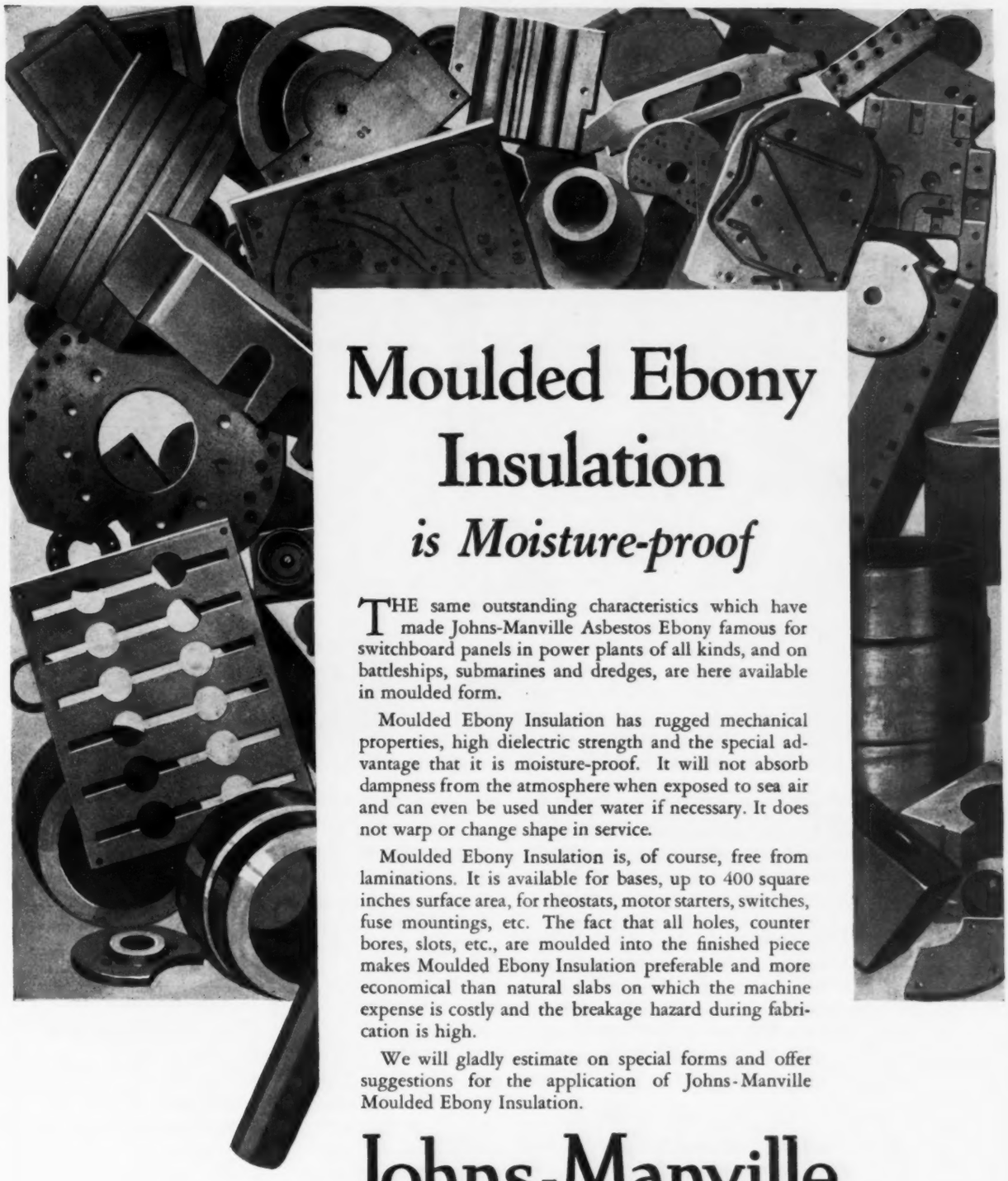
Pasted End Windings

By D. H. Braymer

After having published several articles having to do with the Application of Insulating Materials to Coils and Windings, Electrical Manufacturing has received a number of inquiries for more detailed information about these various practices. In reply to these many questions D. H. Braymer, consulting engineering editor of Electrical Manufacturing and author of the articles, says, with reference to pasted end windings, "After examining some of the jobs done in repair shops I am inclined to believe that the use of pasted end windings is a factory proposition, and should be applied only when definite information is to be had concerning the ventilation for the windings used.

"When paste is applied to end windings, ventilation of the windings is entirely prevented. This paste must be properly and very carefully applied, for, when it dries in service, cracks appear, which in the presence of oil, water or acids, make the windings nothing less than a nuisance. On the other hand, there are definite advantages outlined for the pasted end winding, when properly applied, for they prevent vibration and weaving, and are a good protection to the windings.

"There are several manufacturers of paste for ending windings, and the motor repair man who intends to use it would do well to communicate with the manufacturer, requesting details of application for the particular paste they make, and at the same time setting out details as to the types and kinds of windings it is wanted for and the conditions under which it will be used. When this practice is followed best results are obtained."



Moulded Ebony Insulation

is Moisture-proof

THE same outstanding characteristics which have made Johns-Manville Asbestos Ebony famous for switchboard panels in power plants of all kinds, and on battleships, submarines and dredges, are here available in moulded form.

Moulded Ebony Insulation has rugged mechanical properties, high dielectric strength and the special advantage that it is moisture-proof. It will not absorb dampness from the atmosphere when exposed to sea air and can even be used under water if necessary. It does not warp or change shape in service.

Moulded Ebony Insulation is, of course, free from laminations. It is available for bases, up to 400 square inches surface area, for rheostats, motor starters, switches, fuse mountings, etc. The fact that all holes, counter bores, slots, etc., are moulded into the finished piece makes Moulded Ebony Insulation preferable and more economical than natural slabs on which the machine expense is costly and the breakage hazard during fabrication is high.

We will gladly estimate on special forms and offer suggestions for the application of Johns-Manville Moulded Ebony Insulation.

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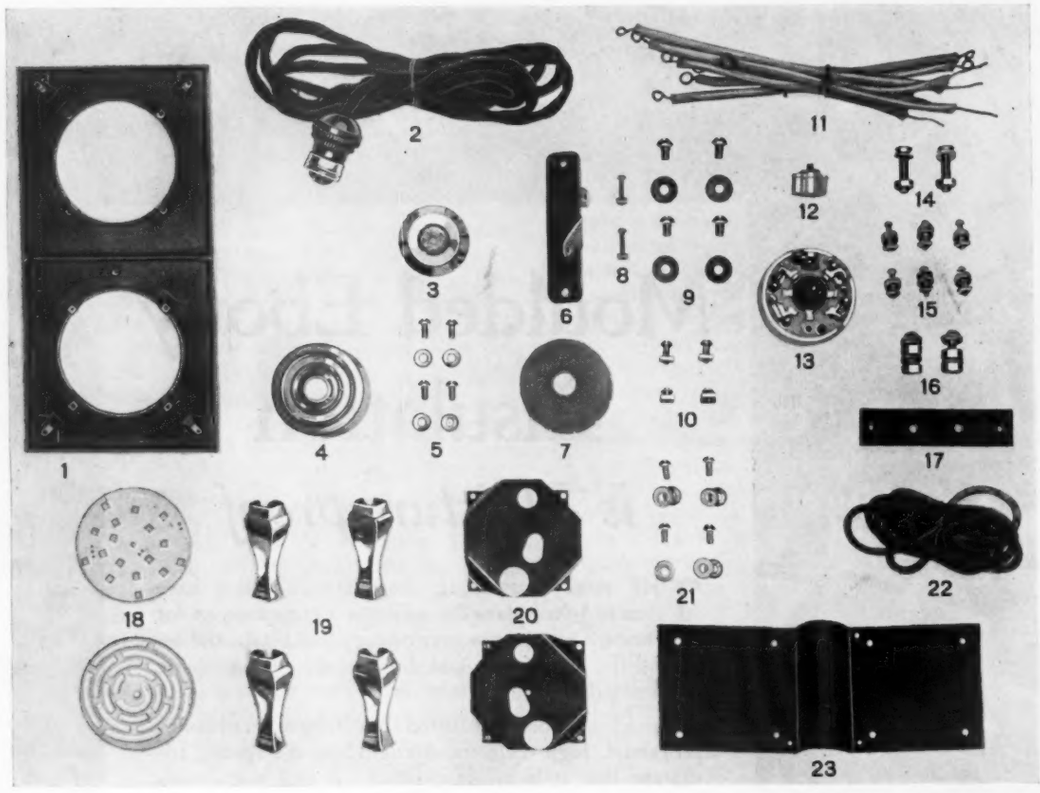
Electric Stove Components



ELECTRICAL MANUFACTURING *acknowledges the assistance of Rock Island Manufacturing Company, Rock Island, Ill., in the preparation of the above illustration of electric stove components. From the Biennial Census of Manufactures for* 1925 *published by the Department of Commerce the annual production of disc stoves, hot plates and ranges under 2½ kw. was* 216,559 *and this annual production was valued at* $1,703,088

Part No.	Description	Material	Annual Production
1	Base	Cast iron	216,559
2	Cord and plug	Rubber, wire, asbestos, cloth,	216,559
3	Indicating switch cap	Brass [copper	216,559
4	Switch housing	Brass	216,559
5	Bottom guard screws	Steel	866,236
6	Switch supporting bracket	Steel	216,559
7	Switch housing liner	Paper	216,559
8	Switch mounting bolts	Steel	433,118
9	Leg bolts	Steel	866,236
10	Terminal block bolts	Steel	866,236
11	Asbestos wire connections	Copper, asbestos	1,180,247 ft.
12	Switch handle	Porcelain, steel, brass	216,559
13	Switch	Porcelain, brass, copper	216,559
14	Hot plate mounting screws	Steel	433,118
15	Element connection bolts	Steel	1,299,354
16	Connection bolts	Steel	433,118
17	Terminal block	Fibre	216,559
18	Heating unit bricks	Porcelain	433,118
19	Legs	Cast iron	866,236
20	Hot plate supports	Steel	433,118
21	Bottom guard screws	Steel	866,236
22	Heating element	Resistance wire	1,515,913 ft.
23	Bottom guard	Steel	216,559

Have you considered the market for raw materials and parts opened up by the annual production of

216,559

electric stoves and hot plates having a valuation of $1,703,088 in 1925?

Super-Micanite...

the modern electric motor insulation

Crane builders demand the best of mica insulation in commutators. Motors must be dependable, must function smoothly and without interruption, despite the frequent surges of current when starting or jogging a load into place.

It is significant that Shaw, too, chose Super-Micanite for this exacting and severe service. The reasons are readily appreciated. Because Super-Micanite is denser than any other pasted mica insulation, commutators are assembled with greater ease. Variations in commutator spacing are eliminated. Slippage and oozing are banished. Even at high temperatures no corrosive decomposition products are formed to attack the commutator.

These are a few of the 10 important advantages of this modern electrical insulation that have made it the choice of America's leading motor builders and electrical manufacturers. The Super-Micanite Bulletin will interest you. Write for a copy.

MICA INSULATOR COMPANY

New York: 200 Varick St. Chicago: 542 So. Dearborn St. Cleveland, Pittsburgh, Cincinnati, San Francisco, Los Angeles, Seattle; Toronto, Montreal.

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MICA INSULATION OILED CLOTH INSULATION

Electrical Manufacturing News

A department containing news, and descriptions of new materials, parts and devices for the manufacture and repair of electrical products

New Circuit Breaker Described at A. I. E. E. Convention

The perfection of the Deion circuit breaker, which was hailed as one of the most important electrical developments in recent years, was publicly announced at one of the sessions of the winter convention of the American Institute of Electrical Engineers in New York City, Jan. 28-Feb. 1. A paper relative to the circuit breaker was delivered by Dr. Joseph Slepian, of the research staff of the Westinghouse Electric & Manufacturing Company.

The new development derives its name from the essential feature of its operation, the deionization of an electric arc, and is based on a new method of interrupting an electric current. The practical introduction of the Deion apparatus will make possible the switching of electrical currents without the hazards entailed in the present methods.

Dr. Frank B. Jewett, director of research and development for the American Telephone & Telegraph Company, was formally presented with the Edison medal on Wednesday evening, Jan. 30. In acknowledging the award Dr. Jewett emphasized the importance of scientific research to industry. He praised the research achievements of the telephone system in particular, saying that in no other field of modern industry had the cooperation of pure science yielded greater results. He foretold a day when the research director in an industry will take part in its business management.

A. L. E. A. Membership Plan Enlarged at Convention

Plans for doubling the membership of the Artistic Lighting Equipment Association, as put in motion at a meeting of the board of directors held in Cleveland, were enlarged at the eighth annual meeting of the association, which was held at Cavalier Hotel, Virginia Beach, near Norfolk, Va., Feb. 5-8. Under the chairmanship of Herman Plaut, of Plaut & Co., New York City, the association seeks to double its membership to a total of 775 during 1929.

Reduction of costs through the use of cost systems, the high cost of distribution and how it can be lowered, credits and collections, and many other vital subjects were discussed at the Virginia Beach meeting. The Illuminating Glassware Guild convened at the same time.

The A. L. E. A. board of directors met at the Cavalier Hotel, Feb. 5, 7.30 p. m. Outstanding features of the remainder of the program were: Wednesday, Feb. 6—Meeting of Illuminating Glassware Guild; stamp and parts manufacturers' meeting; report of Managing Director G. P. Rogers; committee reports. Thursday, Feb. 7—General session; discussion on credits and collections; address by A. L. Powell, manager of the engineering department of the G. E. Edison Lamp Works; nomination and election of officers. Friday, Feb. 8—Meeting of new board of directors; floor and table lamp manufacturers' and lantern manufacturers' meeting; golf tournament.

Radio's Accomplishment

WITH the aid of his invaluable radio compass Captain George Fried, above with the instrument, was enabled to locate the S.S. Florida and rescue the boat's entire crew from turbulent waters

Statistical Expert Predicts Increased Radio Sales

Major R. A. Klock, of Chicago, chairman of the statistical committee of the Nema radio division, has just completed an analysis of the Department of Commerce figures for retail radio sales, prepared in cooperation with the National Electrical Manufacturers Association and recently released, tending to prove that 90 per cent more radio sets will be sold this season than were sold last. His interpretation is based upon a breakdown of the increased totals into sets and accessories, and makes due allowance for the decreased proportion of accessories in the season's total sales.

According to Major Klock, the total average annual business for radio dealers carrying a stock of over $500 for the year 1927 was $11,195. The July-August-September quarter of 1928, for which figures are now available, represented 19.25 per cent of the year's total, or $3,030 per dealer for that quarter, indicating an average business for 1928 of $15,470, or an increase of 32 per cent.

Since the rate of increase indicated by the statistics recently released for this quarter has been more than maintained, it follows that a total sale of not less than $650,000,000 for the 1928-1929 radio year is in prospect. This figure compares with the 1927-1928 total of $500,000,000.

Radio Engineers' Institute Elects New Officers

Dr. A. Hoyt Taylor, superintendent of the United States Radio Research Laboratory, Washington, D. C., and Alexander Meissner, head of the research laboratory of the Telefunken Company, Germany, have been elected president and vice-president, respectively, of the Institute of Radio Engineers for 1929. The officers are to be installed at the February meeting of the Institute, to be held at 33 W. 39th St., New York City.

Arthur Batcheller, Federal Radio Supervisor in New York, and C. M. Jansky, Jr., of the University of Minnesota, were elected to the Institute board of directors for three-year terms. Dr. R. H. Marriott, L. E. Whittemore, and Lewis M. Hull were appointed directors for one year.

New RMA Services Ordered at Briarcliff Session

New services for RMA members and development of many established services were ordered by the RMA board of directors at its two-day session at Briarcliff Manor, N. Y., Jan. 11-12. The board approved a report of and made a large appropriation requested by the foreign trade committee, headed by George H. Kiley of New York, to develop export trade promotion service. RMA members will be sent free of charge an extensive compilation of information regarding radio trade and means for its promotion in many countries.

Establishment at New York headquarters of the RMA of a merchandising bureau in the near future was recommended by the RMA merchandising committee, headed by L. E. Noble of Buffalo, N. Y., and approved tentatively by the board. Merchandising services of many kinds for RMA members and also for radio jobbers and dealers, including special services and collection of statistics, are planned.

New and valuable measures to extend the credit and collection service of the

(*Continued on page 74*)

Why *not* PROFIT

by what sixty manufacturers would tell you about heating units?

FROM your standpoint, these far-sighted manufacturers know what they are talking about. They have been through the experimental stages, made tests. And then found it more economical all around, to adopt Chromalox units—for good.

Built to FIT Your Products

Certainly it's sound business to profit by what they've learned about Chromalox units: How they are built to last; to fit the product itself; to give the right heat. In short, to keep the product operating as it should, for a long time. The patented Chromalox construction of a resistor hydraulically embedded into a heat-conducting, insulating material—makes all this possible.

Lower Assembly Costs

Customers, call us in to help with the final design of their products, to show them the right way to build in the heating units. As a result, assembly costs are lowered. Chromalox units are designed to FIT the product.

Chromalox-equipped Products STAY SOLD

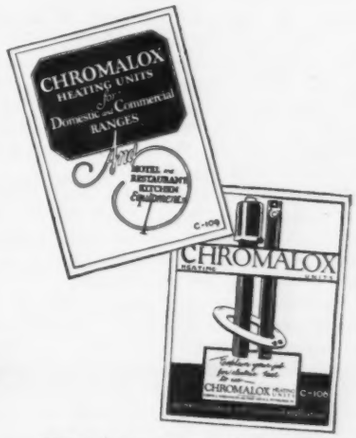
Most of the guess work about your product doing a real job can be easily eliminated by using Chromalox units. Automatically, kicks and come-backs are side-tracked when you use these trouble-free units—another important point those manufacturers will tell you about.

But What About Your Products?

Whether you are working on a new product or improving an old one, we can be of valuable help to you with experience gained from years of working with leading companies making all kinds of electrically heated equipment. When you write for the Chromalox bulletins, tell us about the appliances or heating devices you want properly heated. There's no obligation!

Boiled down to a few words, this is what they'd say . . . .

"Frankly, it is simply a waste of time and money to try to make heating units when it's so easy to buy Chromalox units — really made to fit your products."



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ELECTRIC HEATING UNITS

Write for your copy of these 8-page bulletins showing dozens of sizes and ratings of the largest complete line of heating units.

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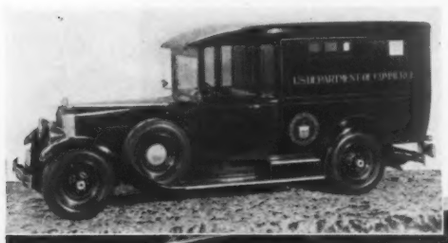
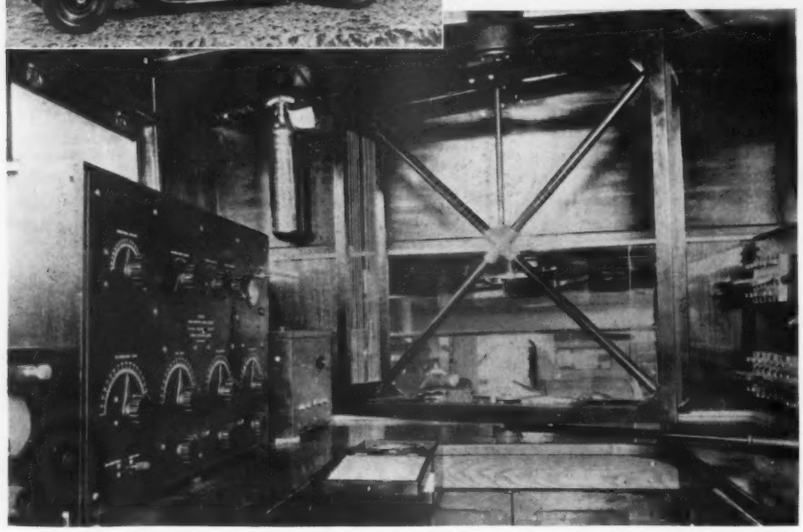
Uncle Sam's Traveling Wave Tester



EFFICIENCY is the keynote of the Commerce Department's checking on radio broadcasting activities. Special cars tour the country and test reception under all conditions. Here is a model of one of these cars and also an interior view



RMA were reported by Theodore Sheldon of Chicago, chairman of the RMA credit committee. New branches at Philadelphia and Boston in the Eastern division, in addition to that at New York, have been established. The credit interchange information service, through the national credit office and the collection service of the New York Credit Clearing House Adjustment Corporation, will be continued and expanded for the use of RMA members.

Report Discloses Wage Rise in Electrical Industry

The importance of wages in general industry has led the National Industrial Conference Board, in cooperation with a large number of manufacturing establishments, building trades and many companies representing various branches of these manufacturing industries to make an investigation in this field and collect data on wages, employment and hours.

In general there are four phases to the wage question: wages in their relation to business conditions, wages and prices, wages and the cost of living, and wages and the amount of employment.

Statistics show that during 1927 there was a remarkable stability in wages paid the laborer in all fields of industry. The boards find that there was no conspicuous change in the level of business between the years 1926 and 1927. While the year 1927 exceeded the year 1926 in the production of raw materials, in mail order sales, electrical energy consumption by manufacturing plants, etc., 1927 was below 1926 in prices, wholesale trade, unfilled orders and factory employment. During these two years there was a close relation between business and wages.

The wage earners of the electrical manufacturing industry, according to statistics, are much better off today than at any time in the history of the industry. The average hourly earnings of the employee advanced from 27.7 in 1914 to 62.1 cents in the fall months of 1920, an increase of about 128 per cent, while living costs had increased between 105 and 93 per cent for the same period. There was a reduction in the wages of the electrical manufacturing industry in the slump of 1921. The wages have increased steadily, though, since 1923. The average hourly earnings for June, 1928, were 61.1, an increase over 1914 of about 126 per cent, while the cost of living in the same period increased about 61 per cent. It would appear that the wages of the earner today is about on a level with the wages in 1920, while the cost of living has decreased 21 per cent. Since 1923 wages have increased 21 per cent, and the cost of living has decreased about 1.7 per cent.

Spain Offers Promising Market for U. S. Electrical Goods

Spain is one of our most promising foreign markets for electrical goods, according to a trade bulletin just issued by the Department of Commerce. During the past five years electrical exports to this market have averaged in the vicinity of $2,000,000 annually, almost every class of electrical goods being represented in these shipments.

Despite a well-organized Spanish manufacturing industry and active competition from other European manufacturers, American electrical equipment is considered standard, the report states. This situation is partly accounted for because of the extensive investments of American capital in Spanish factories and utilities.

Tentative Gear Standards Proposed by A. S. M. E.

A tentative standard for spur gear tooth forms, covering the 14½ and 20 deg. full-depth involute system, has been completed by a committee of the American Society of Mechanical Engineers, and is being distributed for criticism under the American Standards Association designation, B6b-1929. A committee of the American Gear Manufacturers Association cooperated in the work of preparing the standard. Copies of the proposed standard may be procured from C. B. LePage, assistant secretary, A. S. M. E., 29 W. 39th St., New York City.

Electric Crane Companies Announce Merger

Niles Crane Corporation, Philadelphia, and the Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., have announced a consolidation to be known as the Shepard-Niles Crane & Hoist Corporation. The Niles plant at Philadelphia and the Shepard plant at Montour Falls will both continue in operation with the main office at Montour Falls. The officers of the merged companies are: president, Frank A. Hatch; first vice-president, Sydney Buckler; vice-presidents, Robert Turner and James Shepard; chairman of the board, E. A. Deeds.

American Firms Granted Rights to Make Stainless Steel

License rights to manufacture improved stainless steels under the supervision of Prof. Doctor Bebbo Strauss, who discovered the alloys, have been granted by Fried Krupp, A. G., Germany, to the following companies: Central Alloy Steel Corporation, Massillon, Ohio; Ludlum Steel Company, Watervleit, N. Y.; Babcock & Wilcox Tube Company, 85 Liberty St., New York City.

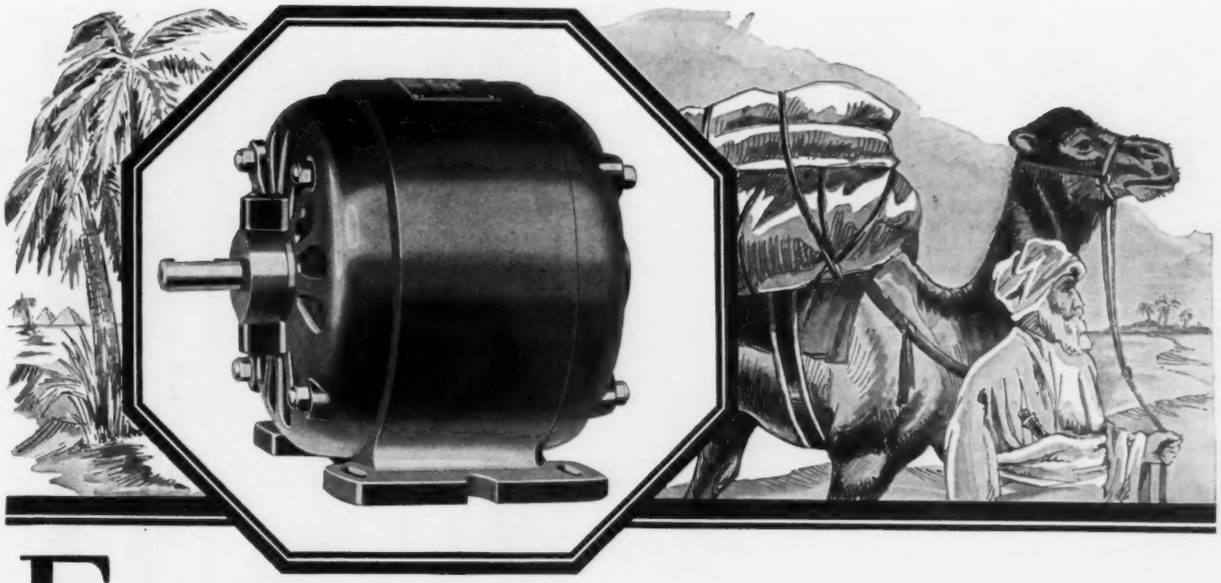
The three concerns licensed have organized for joint research and distribution of the stainless steels. The featured item is "Enduro" KA2 steel, a material which is said to be resistant to water, air, dilute solutions and acids at high temperatures and high pressures. It can be deep drawn, wire drawn, machined readily and welded by electricity or gas. It can be polished to a mirror-like surface, is non-magnetic, and has approximately the ductility of copper.

Standard Underground Cable Co. Effects Personnel Changes

Standard Underground Cable Company, Division of General Cable Corporation, announces the following changes in sales personnel and in branch office locations:

C. J. Marsh, vice-president of the Standard Division, who was manager of the New York sales office, has been transferred to the staff of General Cable Corporation to supervise the purchase of

(*Continued on page* 76)



Endurance—
24 hours a day—

Twenty-four hours a day—three hundred and sixty-five days a year—is the type of service that will test the Quality of any motor.

Ohio fractional horse-power motors are meeting the demands of such service every day. They are built so accurately and under such exacting specifications that they have that extra power and endurance to meet these requirements. Many Ohio Users (list on request) will gladly prove this point from their own experience.

Your motor driven machine or appliance may not require such continuous motor service. However, at only a slightly higher cost, this extra power and endurance of an Ohio Motor is an inexpensive guarantee of reliable, trouble-free operation under all conditions.

After all a good machine or appliance deserves an equally good motor to drive it.

What Users Say!

A prominent manufacturer (name on request) writes:

"It is a number of years now since we have standardized on your motors for our application, which, as you know, is a very severe duty for any motor to perform. Under this severe duty the motor must operate without fail twenty-four hours of the day, and day in and day out throughout the year. Any failure of the motor, no matter how short the duration, would result in an appreciable loss of money to our customer. The motor you are now furnishing to us is, we believe, exactly suited to these conditions and is more or less proved by the comparatively few reports of motor trouble from our customers."

Ohio Motors meet all N. E. M. A. and N. E. L. A. specifications.
Made in sizes of 1/20 to 1/4 H.P.

OHIO reliable MOTORS

THE OHIO ELECTRIC & CONTROLLER CO.
5905 Maurice Avenue, Cleveland, Ohio

OHIO MOTORS

metals. R. S. Hopkins, assistant manager, has been advanced to manager of the New York office and O. G. Miller made assistant manager.

The Atlanta, Ga., office, formerly a suboffice of Washington, D. C., has been made a main branch sales office, and E. B. Hook, Jr., has been appointed manager and J. A. Peacock district manager. New district sales offices, reporting to the Atlanta office, have been opened in Birmingham, Ala., and Charlotte, N. C., with M. L. Tice and W. D. Hampton as district managers, respectively. The address of the Atlanta office has been changed from Candler Building to Healey Building. The Birmingham office is located in the Watts Building, and the Charlotte office in the First National Bank Building.

The location of the Chicago office has been changed from the Conway Building to the Bankers Building. E. J. Pietzcker, formerly manager of both the Chicago and St. Louis offices, is now devoting his entire time to the St. Louis office. The location of the St. Louis office has been changed from the Arcade Building to the Ambassador Building.

A. W. Robertson Chosen Head of Westinghouse Board

Andrew Wells Robertson of Pittsburgh, president of the Philadelphia company, was unanimously elected chairman of the board of directors of the Westinghouse Electric & Manufacturing Company at a meeting held Jan 16 in New York City. He was graduated from Allegheny College in 1906 and from the Law School of the University of Pittsburgh in 1910. After practising law in Pittsburgh he became attorney for the Philadelphia Company, and after serving several years as vice-president of that company he was elected president in 1926. Mr. Robertson, who is 49 years of age, will withdraw from his other affiliations to devote his time to Westinghouse activities.

A. W. Robertson

Brevities

DeForest Radio Company, Jersey City, N. J., sponsored a large banquet as the climax to its three-day sales conference, at the Hotel Biltmore, New York City, Jan. 24. A large attendance which included many men prominent in government, industry, finance and science paid tribute to Dr. Lee DeForest, who related his early trials in developing the vacuum tube and spoke of his present efforts toward improving audions or vacuum tubes for the furtherment of better broadcasting.

Floodlighting Enhances a Structures Beauty

AN outstanding floodlighting installation was recently completed on the tower of the Chicago Tribune Building in Chicago. The size of the building, its permanent location on Chicago's well known Michigan Boulevard and its unusual architectural design makes it probably one of the best known structures in the country. Illumination was provided by 174 *fourteen inch Golden Glow floodlight projectors furnished by the Electric Service Supply Company of Philadelphia. The projector units were equipped with amber lenses to secure a soft golden color*

Delta-Star Electric Company, Chicago, has formed an association with the Monarch Electric Company, St. Johns, Quebec, Canada, whereby the Canadian factory will have the full advantages of Delta-Star designs, engineering and research facilities. A complete line of standardized equipment will be produced at St. Johns for Canadian distribution.

Inland Glass Works, Inc., Chicago, entertained 50 members of the Illinois Illuminating Engineers Society, Jan. 18. A tour of the plant and a discussion of the use of illuminating glassware for better lighting were features of the visit.

Timken Roller Bearing Company, Canton, Ohio, has appointed Judd W. Spray vice-president and general sales manager. He has held the latter position since 1926, previous to which he had headed the automotive sales division in Detroit for several years.

Rainbow Luminous Products, Inc., 120 Broadway, New York City, has created a new operating subsidiary with three plants located in Louisville, Ky., Denver, Colo., and Dallas, Tex. The subsidiary's main office, which is located in Louisville, will handle the production and distribution for its immediate Southern territory, while the Denver and Dallas plants will take care of business in those localities.

Lincoln Electric Company, Cleveland, Ohio, has appointed J. E. Durstine district sales representative at Birmingham, Ala. H. P. Egan has been named district sales representative in Central Ohio, with headquarters at Columbus.

American Electric Switch Corporation, Minerva, Ohio, has appointed Neil B. Walsh direct factory representative in Western Pennsylvania, with headquarters in Pittsburgh. J. E. Cameron, manufacturers' agent, has been named to handle the company's line of switches in Western Missouri and Kansas, with headquarters in Kansas City, Mo.

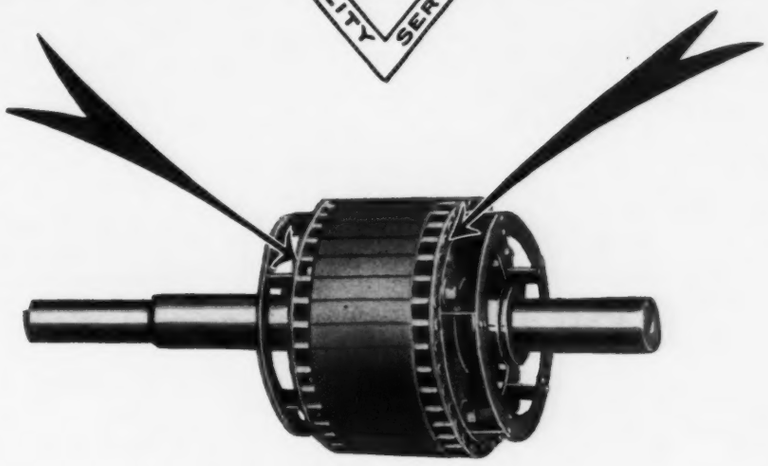
Standard Underground Cable Company, Pittsburgh, a division of the General Cable Company, has announced plans for the building of an addition to its plant on Washington Street, Perth Amboy, N. J., to be used as a wire and rod mill. The present wire and rod department will be removed to the new quarters and the vacated space will be utilized for cable manufacture. Cable production in Pittsburgh will be discontinued and the equipment will be moved to the Perth Amboy and St. Louis plants. The company's general offices will remain in Pittsburgh.

Hardwick, Field, Inc., announces that, due to the retirement of W. Thayer Field and the election of John C. Hindle as his successor, the firm's name has been changed to Hardwick, Hindle, Inc. Mr. Hardwick remains as president and general manager, while Mr. Hindle is in charge of sales. Because of increased business, the company has recently added a new wing to its plant and enlarged its engineering staff. It offers service to manufacturers who desire resistors built to specifications.

Jacob Landau has moved his office and repair shop from 200 E. Twelfth Street, New York City, to 132-134 Essex Street,

(*Continued on page* 78)

HANDY & HARMAN
FOUNDED 1867
QUALITY SERVICE



Brazed with "Handy" Silver Solder

A NATIONALLY known maker of "squirrel cage" induction motors furnishes the above photograph showing an interesting use of *"HANDY" Silver Solder.*

The copper rotor bars are brazed to the copper or alloy metal end rings with Handy Silver Solder. The free-flowing properties of "Handy" silver solder permit the use of a rig in which the parts are revolved through an oxy-acetylene torch flame, and brazed by the operator, in multiples. Rotors for motors all the way from 1 h.p. to 150 h.p. are silver-brazed in this way and a uniform result is secured. Brazing time is so short, compared with methods formerly used that silver solder is an ultimate manufacturing economy.

How They Used to Do It

In this work the former practice was to use soft solders on some types and riveting or upsetting on others. Soft solders proved to be unsatisfactory because they sometimes encountered destructive operating temperatures and upsetting, or riveting, was a slow and costly production operation.

Characteristics of Handy Silver Solders

High electrical conductivity, marked resistance to shock, vibration and corrosion, small amount of solder needed per joint; compactness, neatness, and uniformity of connections and the dependable physical and metallurgical uniformity of the solders themselves are features in their rapidly-widening use in electrical crafts, for such operations as:

1. Securing resistance wire to terminals and leads in resistors.
2. Joining all leads or joints that are subject to rise in operating temperature above the critical point of soft solders.
3. Joining bus-bars, contactors, etc.
4. Sealing radio, X-ray or other bulbs.
5. Joining commutator segments.
6. For all joints subject to corrosion, vibration or shock.

Standardization

After many years of effort we have succeeded in standardizing silver solders to a dozen guaranteed formulas. Each of these represents a definite proportioning of silver with copper, zinc or other metals to secure working characteristics suited to definite groups of requirements. The mixtures range from 80% silver down to 10%, and in melting points from 1325°F, for the formulas higher in silver up to 1600°F for the low-silver compositions.

Let Us Help You

to determine which of our compositions lowest in silver (and hence least expensive) will best meet your operating conditions. Write fully. Our technical staff will give you the benefit of its records of thousands of tests, some of which will doubtless parallel your problem. Or, in the case of special production problems send us the parts you join, so that we can make special tests.

"The 'Handy' Book of Silver Solder E"

Contains much valuable information about soldering, brazing and welding. Ask for a copy.

HANDY & HARMAN

General Office:

57 WILLIAM STREET, NEW YORK CITY

PLANTS: Bridgeport, Conn. Providence, R. I. Fulton and Gold Sts., New York City.

Jersey City, N. J., where he is carrying on his general repairing practice, specializing in electric time switches.

Thomas E. Murray, Inc., announces the removing of its New York offices from 55 Duane Street, to 88 Lexington Avenue, where the firm occupies the entire eighth floor. Thomas E. Murray, president, formerly general manager and senior vice-president of the New York Edison and affiliated companies, is now devoting his entire time to the development of his patents and his firm's general designing and consulting engineering practice.

Cutler-Hammer, Inc., is the new name for the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., manufacturer of electric motor controls, power devices, and kindred products. The officers of the new company, a Deleware corporation are: Chairman of the board, F. R. Bacon; president, B. L. Worden; vice-presidents, J. C. Wilson and F. L. Wilson; treasurer, H. F. Vogt; secretary, W. C. Stevens.

Arcturus Radio Tube Company is the new name for the Arcturus Radio Company, Newark, N. J.

Day-Brite Reflector Company, St. Louis, Mo., manufacturer of commercial lighting equipment, announces removal from 703 South Broadway to a new and larger factory at 3825 Laclede Avenue, St. Louis. The new quarters were necessitated as a result of the company's rapid growth. A large electric oven has been installed in the plant and the firm will now take care of its own porcelain enameling work.

General Refractories Company, 104 South Sixteenth Street, Philadelphia, has opened a San Francisco office at 742 Russ Building. W. E. Dornbach, formerly head of the Philadelphia office, is in charge.

Westinghouse Lamp Company, New York City, announces the addition of Arthur J. Sweet, formerly in consulting practice in Milwaukee, to its commercial engineering department.

Piqua Electric Manufacturing Company, Piqua, Ohio, is the new name for the Piqua Electric Service Company, for the manufacture of fans only. The firm will continue to repair motors under its old name.

Personals

Robert G. Kittle, for many years connected with the Benjamin Electric Manufacturing Company, has become associated with Leslie Ablett of the Paramount Manufacturing Company, 79 Orange Street, Newark, N. J., in the manufacture of rectifying tubes.

Bernard Badrian, former supervisor of the wiring promotion department of The Society for Electrical Development, has resigned from this position to become associate in the firm of Goodwin, Morton & Badrian, market counselors, 522 Fifth Avenue, New York City. Robert G. McPhail, of the league and field department of the Society, has been appointed temporarily to fill the vacancy.

H. A. Baker of Schenectady has been appointed service manager of the International General Electric Company, with headquarters in New York City. He succeeds C. F. Neave, who has been named head of the company's newly organized refrigeration department.

M. A. Gordy has been appointed Southeastern manager for the U. S. Electrical Tool Company, with offices located in the Norris Building, Peachtree Street, Atlanta, Ga. For the past few years he has handled a number of lines as manufacturers' agent.

Robert M. Gates, manager of the industrial department of the Superheater Company, has been elected vice-president. He has been associated with the company since 1922, directing the engineering and sales of superheaters for stationary power plants and special pipe coils for the oil and other industries. He is a native of Iowa and a graduate of Purdue University.

Herbert M. Bray, for the past five years manager of the Chicago office of the Colonial Steel Company of Pittsburgh, has been appointed assistant salesmanager of the Midwest branches.

Obituary

J. L. Jones, chief chemist of the Westinghouse Electric & Manufacturing Company, died Jan. 21, at Green Cove Springs, Fla., at the age of 64. He was a native of Ohio and a graduate of Ohio State University. Before joining Westinghouse in 1902, he headed the testing department of William Cramp & Sons, shipbuilders of Philadelphia.

Frank E. Johnson, Chicago district manager of the Ohio Brass Company, died suddenly at his home in Chicago, Jan. 16. He had been associated with the company for 21 years.

Rodney Morison, Jr., for the past four years Southern manager for the National Carbon Company, died in New York City, Jan. 11. Mr. Morison, who was 41 years old and a native of Philadelphia, was formerly stationed at the National Carbon Company's office in Cleveland.

Manufacturers' Catalogs

Monitor Controller Company, Baltimore, Md. Bulletin No. 113, alternating-current automatic starter.

Major Equipment Company, 4603 Fullerton Avenue, Chicago. Bulletin No. 12, chromium-plated reflectors.

Penn Electric Switch Company, Des Moines, Iowa. Booklet, automatic switches and other controlling devices.

Wagner Electric Corporation, St. Louis, Mo. Bulletin No. 158, small vertical motors. Bulletin No. 160, distribution transformers; No. 153, split-phase motor.

Crouse-Hinds Company, Syracuse, N. Y. Bulletin No. 2126, threadless condulets, connectors and couplings.

Revolvator Company, Jersey City, N. J. Bulletins No. 83 E and F, new Revolvator equipment, electrically arc welded platforms, double channel uprights and equalizing channel rollers.

Coming Conventions

American Society for Testing Materials.—Annual meeting at the Chalfonte-Haddon Hall, Atlantic City, N. J., June 24-28.

Federated Radio Trades Association.—Meeting at Buffalo, N. Y., Feb. 18-20.

Midwest Power Conference and Exhibition.—Fourth show at the Coliseum, Chicago, Feb. 12-16, 1929.

National Electric Light Association.—Annual convention and exhibition at the Municipal Auditorium, Atlantic City, N. J., June 3-7.

National Electrical Manufacturers Association.—Annual meeting at Hot Springs, Va., week of May 20.

National Electrical Wholesalers Association.—Meeting of executive committee at the Mayflower, Washington, D. C., Feb. 26-27. Semi-annual convention at the Homestead, Hot Springs, Va., May 27-31.

The Society for Electrical Development.—Meeting of the board of directors at New York City, March 8.

Information Wanted

We have been asked for the names and addresses of manufacturers of the articles listed herewith.

Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of ELECTRICAL MANUFACTURING, 461 Eighth Ave., New York City.

"Burrows'" Therapeutic Lamp.
"L. R. Co." Receptacles.
"Splendida" Electric Iron.
"Sal Co. 176" Lamps.
"Electron" Heating Pad.
"Lilly Wilson" Vacuum Cleaner.
"Perkins" Siren.
"Flint" Waffle Iron.
"Packard" Vacuum Cleaner.
"Blaisdell" Automatic Electric Cigar Lighter.
"Vesodore" Cigar Lighter.
"Columbus-Universal" Electric Vacuum Cleaner and Floor Polisher.
Manufacturers of electric-driven lampshade lacing machines.
Manufacturers of Electric Incinerators.

Standardize on Angle Steel – it PAYS!

PLACE your purchases here for factory and office equipment! Promote efficiency, cut costs and boost profits with ANGLE STEEL EQUIPMENT, which brings you a *lifetime of service.*

Send for CATALOG "C" which describes and illustrates hundreds of shop and office items—sanitary, durable and economical.

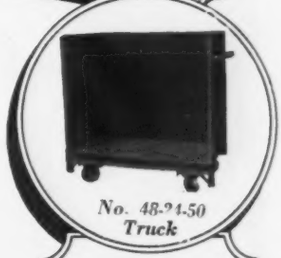
Special Equipment built to your order. Plans, specifications and prices furnished without obligation to you.

ANGLE STEEL STOOL COMPANY

Plainwell, Michigan, U. S. A.

New York City—Angle Steel Stool Sales Co., 98 Park Place
Chicago—Lothrop Angle Steel Equipment Co., 325 W. Madison

No. 5-26 Bench Legs



No. 48-24-50 Truck

No. 29 Desk

The most popular selling bench leg built. Four-inch projection on one end of flat top which is five inches wide. Rigidly constructed and firmly braced. Very substantial where great weight is used. Properly punched for fastening on of wood planks. Made in five heights, ranging from 26″ to 36″.

Note—Special sizes for individual requirements made to your order.

No. 5-26 Bench Legs

Permanence in Steel

ANGLE STEEL EQUIPMENT OF STEEL

ECONOMICAL - SANITARY - DURABLE

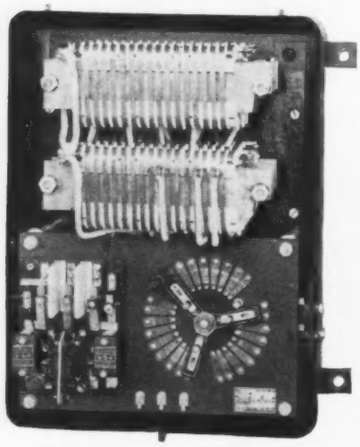
New Goods for Your Inspection

Current Transformer

Weston Electrical Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J., introduces to the trade its model No. 539 current transformer; small, of light weight, and with a wide range of measurement. It has a 1-amp. secondary, and when used with a proper instrument of that range, current measurements can be made from 0.2 to 200 amps. Model 359 has four self-contained primary ranges of 2, 5, 10 and 20 amps. Ranges of 200, 100 and 50 amps. are also available. It is completely inclosed in mottled red and black bakelite case.

Speed Controller

General Electric Co., Schenectady, N. Y., announces a new speed controller, for slip-ring induction motors, and primarily intended for machines where the amount of torque required decreases as the speed is reduced. This new device has the primary magnetic switch, dial type controller and speed regulating resistance mounted in a sheet-steel enclosing case. The controllers provide overload and undervoltage protection and give approx-



imately 50 per cent reduction by inserting resistance in the rotor circuit. Each controller consists of a line contactor, a temperature overload replay, a secondary dial switch operated from the outside of the cover, a resistor, and a "Start-Stop" push-button station. The enclosing case is ventilated and provided with knockouts in the top and bottom. The push-button station is mounted in the enclosing case, with its buttons extending through the right-hand side. In operation, the line contactor is closed by pressing the "Start" button, thus starting the motor. Speed regulation is obtained by moving the dial switch arm on the front of the enclosing case. The dial switch and line contactor are not interlocked, and consequently the motor will come up to the speed corresponding to the setting of the dial switch. It is, therefore, possible to throw the motor directly on the line with all resistance cut out of the secondary in case the dial switch arm is in full speed position. Stopping the motor is done by pressing the "Stop" button.

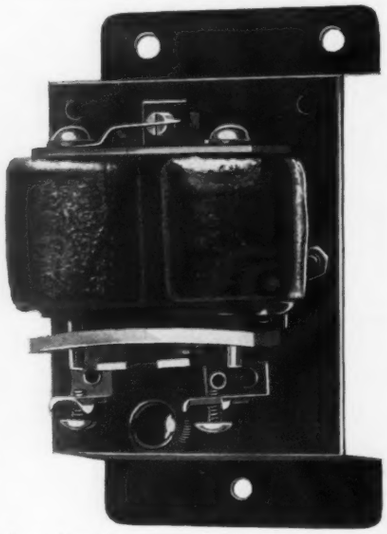
Safety Switch

Bull Dog Electric Products Co., 7610 Jos. Campau Ave., Detroit, is offering to

the trade its Type A line of safety switches, with an improved handle. This handle is constructed of heavy malleable casting instead of a pressed steel handle with a wooden knob, heretofore used. This improved handle does not apply to Type C, secondary line of safety switches.

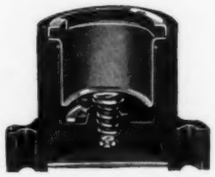
Motor Protector

Burke Controller Co., 369 Lexington Ave., New York, has placed on the market a motor protector, for fractional horsepower motors, provided with an inverse



time element to permit the motor to start. It is designed to protect motors against overload, stalling, failure of the centrifugal switch, and other causes of motor burnout. When the motor is overloaded for a predetermined time, the protector opens the circuit and starts a buzzing noise to indicate that the circuit is open. It is automatically reset by opening and closing the control switch. This device is available for motors ranging from 1/50 to 1 hp.

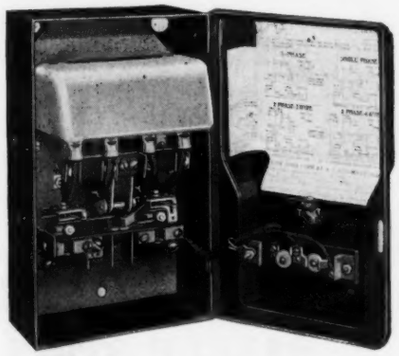
Airfield Light Socket



Bryant Electric Co., Bridgeport, Conn., announces a prefocusing socket, especially for the control of light on air routes and landing fields. It is used also in connection with photo-electric cells in photophone equipment and for general photographic work. Lamps used with these sockets are: 110 volt, 115 volt, T8½ bulb and 200 watt, 115 volt, T10 bulb coiled filament projection lamp. Lamps are not furnished by this company.

Remodeled Starter

Allen-Bradley Co., 493 Clinton St., Milwaukee, Wis., is offering its J-1552 Form B Starter in a new and longer cabinet. No change has been made in the



internal mechanism of the starter, and it remains at the same rating of 5 hp., 220 volts, and 7½ hp., 440 or 550 volts. The new model is known as the Allen-Bradley Bulletin 709 Starter. The inside length of this new model has been increased 1⅞ in. over the old J-1552 Form B Starter, providing liberal space at both top and bottom of the cabinet for convenient and safe wiring. The Bulletin 709 Starter is furnished in three forms: Form 1, with push buttons in the cover; Form 2, for remote control; Form 3, with lever switch for automatic or manual control.

Appliance Switch

Cutler-Hammer, Inc., Milwaukee, is marketing a feed-through switch, for use

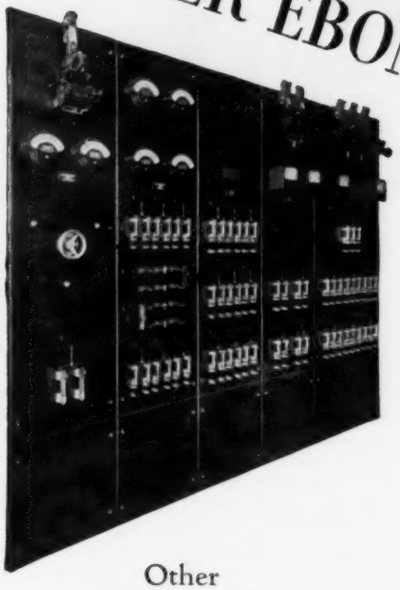
with household appliances and small industrial tools. This switch, called the C-H 70-50 pushbutton switch, is designed to decrease the time usually required to wire switches of this type.

DOWN THE LINE WITH

AMBLER EBONIZED ASBESTOS LUMBER

The above Switchboard was built for Haverford College, Haverford, Penna., by Walker Switchboard Company, Philadelphia, using 1½" Ambler Ebonized Asbestos Lumber.

The Switchboard at the left, built by the same Company, using the same material, and installed at the Delaware Power Company, Vienna, Md.



Here is the ideal material for Switchboard and similar uses in the electrical industry. It has great physical and dielectric strength, as well as an attractive appearance.

It is strong and easily worked, drilled or counter-sunk. It is highly impervious to moisture. Can be supplied in standard or panel finish, in thicknesses from ⅛" to 2", or even thicker if required.

Ambler Ebonized Asbestos Lumber is approved by the Underwriters' Laboratories and meets all U. S. Navy Specifications.

Other Ambler Asbestos Products

Ambleroid Moulded Parts for sockets, barriers, resistance bases, etc.

Ambler Asbestos Lumber for barriers, cell compartment partitions, panels, switch box lining, table tops, etc.

Ambler Linabestos for exterior and interior sheathing.

Ambler Asbestos Shingles for all roofs.

Ambler Asbestos "WALTILE."

ASBESTOS
SHINGLE, SLATE & SHEATHING COMPANY

Factories: Ambler, Pa.; St. Louis, Mo.

Branches in Principal cities

Cable Connector

Appleton Electric Co., 1701 Wellington Ave., Chicago, is manufacturing No. 7280 connector, furnished with a U-type adjustable clamp, for use with non-metallic sheathed cable or loom. This connector has a copper screw on the side for grounding the neutral wire. A notched nut makes it easy to fasten with an ordinary screw-driver and hammer. Forty-five and 90 deg. and double connectors are also furnished with the U-type clamp and screw for grounding neutral wire.

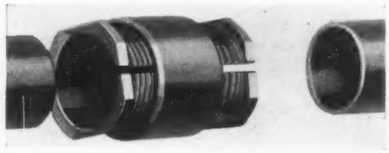
Diamond H Switch

Hart Mfg. Co., Hartford, Conn., announces its Diamond H heavy-duty heater switch, designed primarily for heavy duty commercial range and water heater work.

The style clock spring used in this switch provides quick make and break connection. These switches are furnished in standard type, with black porcelain base, black bakelite cover, with white indications and porcelain handle. The exposed steel parts are cadmium plated, preventing oxidation. The base diameter is 4 in. The screw-hole spacing is 2 11/16 in.

Threadless Conduit

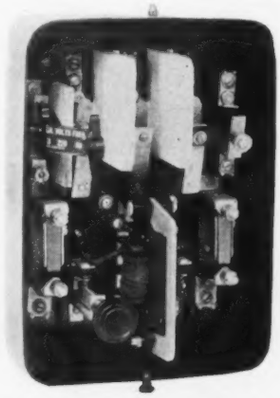
Steel & Tubes, Inc., Cleveland, Ohio, announces a thin-walled, threadless rigid conduit, which is attached by the use of



a simple adapter, shown in the illustration. It can be used with a standard threaded or threadless fitting. It is available in sizes corresponding to ½ in., ¾ in., and 1 in. heavy conduit, in ten foot lengths. Exterior is galvanized and interior baked enameled.

General-Purpose Starter

General Electric Co., Schenectady, N. Y., announces the addition of two switches to its line of general-purpose starters, for small alternating-current motors. Above is a view of the three and four-pole magnetic switch, with self-contained "start" and "stop" stations, and the second switch is for similar service, but especially designed to provide ample wiring space. The type shown in the illustration consists of a triple-pole, barrier-type contactor and a double-coil temperature overload relay, all



mounted on a molded base in a drawn-shell, steel enclosing case. The second type, although for the same general class of application, is designed for use with remote push-button stations. The switch mechanism is located below the center of the box to prevent interference with the mounting holes. There is also ample room for the arc, preventing flashovers.

Paste Core Solder

Chicago Solder Co., 4210 Wrightwood Ave., Chicago, is manufacturing Kester solder in the form of wire, with a paste

core. It is made of virgin tin and lead in a hollow wire form, filled with a soldering paste that is pocketed in such a manner as to allow just the right amount to be released as heat is applied to the solder. In each box are 150 18-in. lengths of No. 5 gage (3/32 in.) solder.

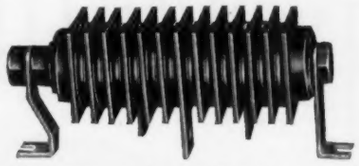
Rubber-Mounted Motor

Wagner Electric Corp., St. Louis, is offering to the trade its rubber-mounted motor, Model No. 57-RA, developed for electric refrigeration. The motor is insu-

lated from the supporting base by means of rubber bushings. The outfit is designed to be practically rigid, and shaft alignment is said to be in no way endangered. Overall length and width remain the same as heretofore. The motor is of the brush-lifting type, the brushes being lifted from the commutator as soon as the rotor attains operating speed. Governor weights have rubber bumpers.

Dry Rectifier

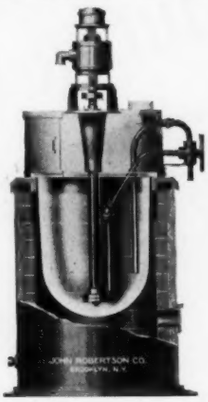
Benwood-Linze Co., 19th St. and Washington Ave., St. Louis, announces Type



B-24, full-wave, dry rectifier for use with dynamic speakers, power devices, chargers, etc. Capacity is from 1 to 3 amps. at 8 to 12 volts. It is equipped with horizontal mounting brackets.

Lead Melting Pot

John Robertson Co., 121 Water St., Brooklyn, N. Y., is marketing a lead melting pot equipped with a lead pump and designed for use by electric cable and rubber hose manufacturers. This pot, instead of being equipped with the ordinary valve seat and hand operated valve, is provided with a motor-driven centrifugal pump capable of pumping 2,000 to 2,500 lbs. of lead



per minute. The pump is supported in a housing with special bearings and is connected by means of a flexible coupling to the motor, which is mounted on top of the hood. The furnace and the hood are lined with insulating materials and the bottom of the furnace is arranged so that any type of gas or oil burner can be used. The pump is designed to operate continuously so that the lead in the pot is in continuous motion. The pot illustrated has a holding capacity of 20,000 lbs.

Binding Post

J. L. Polk, 3 Lakewood Place, Troy, N. Y., has brought out a push type binding post, which eliminates the necessity of

inserting a wire in the post. A cap having a knurled edge is fastened to the top of the post, and the movable portion of the device slides up and down on the shaft. The wire to be connected to the post is simply looped around the shaft.

Appearance

...a powerful sales factor in 1928

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Reduced unit costs
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Complete interchangeability and simpler, faster assembly
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Release of working capital
Elimination of manufacturing "grief"

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Fewer adjustments and less "free service" required
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Stewart

EM2-Gray

Index of Raw Materials, Parts, Electrical Equipment

For all electrical products including electrically operated machines and appliances

Trade Names—Manufacturers' Names—Local Addresses

The names of all manufacturers are grouped alphabetically under the heading for the product they manufacture. Trade names also appear in alphabetical position under the subject identifying the product. Thus "Linolac" insulating varnish will be found in alphabetical position under the heading "Paint, Varnish, Lacquer."

Note: The Classified Index of ELECTRICAL MANUFACTURING is limited to those subjects of interest to the specific field which it covers, for obvious reasons. A complete Classified Index of all electrical commodities bought, sold, or used by Electrical Supply Jobbers, Contractors, Dealers, Central Stations and other electrical industry outlets appears regularly in each issue of ELECTRICAL RECORD as heretofore. This Classified Index has been an exclusive ELECTRICAL RECORD feature for over thirty-six years.

ALLOYS, LIGHT METAL
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.

ALUMINUM
(Also Aluminum Bronze Powder.)
Albron, Alloca, Alsmac. See Aluminum Co. of America.
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh.

ANMETERS. See Instruments.

ARMATURE
Balancers. See Balancers, Armature.
Banding Machines. See Banding Machines, Armature
Bearings. See Bearings.
Buggies. See Lifts, Armature.
Coil Presses. See Presses, Armature Coil.
Coils. See Coils, Finished.
Core Punchings. See Discs, Armature.
Cranes. See Lifts, Armature.
Discs. See Discs, Armature.
Driers. See Ovens.
Growlers. See Testers, Coil.
Hoists. See Lifts, Armature.
Impregnators, Vacuum. See Ovens, Industrial.
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Laminations. See Discs, Armature.
Lathes. See Lathes.
Lifts. See Lifts, Armature.
New. See Coils, Finished.
Notching Machines. See Notching Machines, Armature.
Pegs. See Pegs, Armature.
Pinion Pullers. See Pullers, Armature Shaft.
Repaired. See Repairing and Second-Hand.
Shaft Pullers. See Pullers, Armature Shaft.
Shaft Straighteners. See Straighteners, Armature Shaft.
Stands. See Stands, Armature.
Test Benches. See Test Benches, Armature.
Testers. See Testers, Coil; also Test Benches, Armature.
Torpedo Cord. See Twine, Armature Winding.
Trouble Shooters. See Testers, Coil; also Test Benches, Armature.
Trucks. See Lifts, Armature.
Wedges. See Pegs, Armature.
Winding Machines. See Winding Machines, Armature & Field Coil.
Winding Twine. See Twine, Armature.

ARMATURE & COIL SPRAY GUNS. See Spraying Outfits.

ARMORING MACHINES. See Wire Manufacturing Machines.

ARMS, FLEXIBLE. See Tubing Flexible Metallic.

ASBESTOS Shades. See Shades, Fabric.
Paper & Sheet. See Asbestos.
Slabs. See Asbestos Slabs.
Tape. See Tape, Asbestos.
Wire. See Wire, Insulated.
Yarn and Thread. See Yarn and Thread.

ASBESTOS
Sheet, Paper, Mill Board, Lumber.
Asbestos, Shingle, Slate & Sheathing Co., Ambler, Pa.
Easco. See Eastern Asbestos Co.
Eastern Asbestos Co., Providence, R. I.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp., New York, N. Y.

ASBESTOS SLABS
Slabs & Barriers for Switchboard.
Asbestos-Ebony. See Johns-Manville, Inc.
Decelsco, Inc., Wayne, Mich.
Johns-Manville Corp., New York, N. Y.
Transite. See Johns-Manville, Inc.
Zellite. See Decelsco, Inc.

BAGS, Vacuum Cleaner
Merrimack Mfg. Co., Boston, Mass.

BALANCERS, Armature
(Dynamic Balancing Machines—Balancing Ways).
Anderson Bros. Mfg. Co., Rockford, Ill. (Ways).
Armature Coil Equip. Co., 2415 Forestdale Ave., Cleveland, O. (Machine).
Bowsher Co., N. P., South Bend, Ind.
Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. (Machines).
Sundstrand Machine Tool Co., Rockford, Ill.
Twentieth Century. See Sundstrand Machine Tool Co.
Vibration Specialty Co., 1534 Winter, Philadelphia, Pa. (Machine).

BALL BEARINGS. See Bearings, Ball and Roller.

BANDING MACHINES, Armature
Columbia Machine Wks. & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.

BARRIERS, Switchboard. See Slate; also Soapstone; also Asbestos.

BARS, BUS. See Brass, Bronze & Copper; also Aluminum.

BARS, Commutator
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Buckeye Tempered Copper & Brass Co., Mansfield, O.
Cameron Electric Mfg. Co., Ansonia, Conn.
Commutator Co., 131 N. Front, Minneapolis, Minn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., 4743 Hough Ave., N. E., Cleveland.
Rome Brass & Copper Co., Rome, N. Y.

BASES, Radio Tube. See Radio Molded Parts.

BASES, Reading Lamp
Metal, Pottery, Wood & Glass.
American Ring Co., Waterbury, Conn.
Aladdin Mfg. Co., Sales Div. No. 802, Muncie, Ind.
Armor Bronze Co., Garwood, N. J.
Camden Art Tile & Pottery Co., Camden, Ark.
Colonial. See Old Colony Iron Wks.
Estes & Sons, E. B., 5344 Grand Central Terminal, New
Fulper Pottery Co., Flemington, N. J.
Globe Metal Spinning Co., 178 Centre, New York, N. Y.
Hamill Products, Inc., 103 Mott, New York, N. Y.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Marbleart. See Insulation Mfg. Co.
Natural. See Insulation Mfg. Co.
Old Colony Iron Wks., Bridgeport, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sneath Glass Co., Hartford City, Ind.
Van Briggle Tile & Pottery Co., Colorado Springs, Colo.
Weller, S. A., Zanesville, O. (Pottery.)
Yokel Corp., 219 Homestead Ave., Hartford, Conn.
Zane Pottery Co., South Zanesville, O.

BATTERY CHEMICALS. See Chemicals, Battery.
BATTERY CUT OUTS. See Switches, Battery.
BATTERY GAGES. See Instruments, Pocket.
BATTERY JARS. See Jars, Battery, Glass; also Rubber; also Molded Insulation.
BATTERY OXIDES. See Chemicals, Battery.
BATTERY SALTS. See Chemicals, Battery.
BEAD CHAIN. See Chain, Socket.
BEADS, Chandelier. See Crystals, Chandelier.

BEADS, Insulating
American Lava Corp., 1425 William, Chattanooga, Tenn.
Dunco. See Struthers Dunn, Inc.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.

BEARINGS
Ball & Roller. See Bearings, Ball & Roller.
Graphite. See Bearings, Oil-less.
Oil-less. See Bearings, Oil-less.
Sleeve. See Bearings & Bushings.

BEARINGS, Ball and Roller
Ahlberg Bearing Co., 317 E. 29th, Chicago, Ill.
Bantam Ball Bearing Co., South Bend, Ind.
Commercial. See Schatz Mfg. Co.
C J B. See Ahlberg Bearing Co.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Poughkeepsie, N. Y.
Gurney. See Marlin-Rockwell Corp.
Hyatt Roller Bearing Co., Newark, N. J.
Hoffman. See Norma-Hoffman Bearings Corp.
McGill Metal Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
New Departure Mfg. Co., Bristol, Conn.
Nice Ball Bearing Co. (Nicetown), Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Reiter Bearing Co. of America, Whitehead Rd., Trenton,
Schatz Mfg. Co., Poughkeepsie, N. Y.
Schubert. See McGill Metal Co.
Standard Steel & Bearings, Inc., Plainville, Conn.
Strom Bearings Co., 4587 Palmer, Chicago, Ill.
S. K. F. Industries, 40 E. 34th, New York, N. Y.
Timken Roller Bearing Co., Canton, O.
Torrington Co., Torrington, Conn.

BEARINGS, Oil-Less
Argute Oilless Bearings Co., 149 Berkeley, Philadelphia, Pa.
B. M. C. See Burlington Metal Corp.
Bogert & Hopper, Inc., 235 Varick, New York, N. Y.
Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Burlington Metal Corp., Burlington, Wis.
Cleveland Graphite Bronze Co., 880 E. 72nd, Cleveland, O.
Electric Railway Equipment Co., 30 Church, New York, N. Y.
Elreco. See Electric Railway Equipment Co.
Graphalloy. See Graphite Metallizing Co.
Graphite Metallizing Co., Yonkers, N. Y.
Lubrite. See Merriam Bros., Yonkers, N. Y.
Merriam Bros., 185 Amory, Boston, Mass.
Metal Saw & Machine Co., Springfield, Mass.
Neveroil Bearing Co., Wakefield, Mass.
Nois Oilless Bearing Co., 6 E. Johnson, Philadelphia, Pa.
O. & S. Bearing Co., 315 S. Artillery, Detroit, Mich.
Reliance. See Metal Saw & Machine Co.
Seib Lignum-Vitae Woodturning Co., 98 Boyd Ave., Jersey City, N. J.
United States Graphite Bearing Co., Saginaw, Mich.

BEARINGS AND BUSHINGS
(For Armature Shafts.)
Adjustable Bearing Co., 101 Transportation Bldg., Indianapolis, Ind.
Ajax Metal Co., Philadelphia, Pa.
American Bronze Corp., Berwyn, Pa.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bunting Brass & Bronze Co., Toledo, Ohio.
Damascus Bronze Co., Pittsburgh, Pa.
Durex. See Moraine Products Co.
Flood City Mfg. Co., Johnstown, Pa.
Johnson Bronze Co., New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.
Moraine Products Co., Dayton, O.
National Bearing Metal Corp. (More-Jones Brass & Metal Div.), 4930 Manchester Ave., St. Louis, Mo.
United States Graphite Co., Saginaw, Mich.

BELTING, Chain Transmission. See Chain, Power Transmission.

BELTS, Rubber
Molded Cord Rubber Belts for Electrical Appliances.
Fay Rubber Products Co., Elyria, O.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.

BENDERS, Coil Loop
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

BENDING. See Punching & Bending.
BINDING POSTS. See Posts, Binding.

BLADES, Fan
Estes & Sons, E. B., 5344 Grand Central Terminal Bldg., New York, N. Y.
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y.
Torrington Mfg. Co., Torrington, Conn.

BLUESTONE. See Chemicals, Battery.
BOARD, Fuller. See Cloth and Paper.
BOARD, Press. See Cloth and Paper.
BOWL HOLDERS. See Fixture Fittings.
BOX & CABINET BUSHINGS. See Bushings, Box & Cabinet.

BOX BOARD
Container Corp. of America, 111 W. Washington, Chicago.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Fibre
Container Corp. of America, 111 W. Washington, Chicago.
Corrfibre. See Container Corp. of America.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Sheet Steel. See Cabinets, Sheet Steel.
BOXES, Wood. See Cabinets & Boxes, Wood.

BOXES AND WRAPPERS
Brown & Bailey Co., 417 N. Eighth, Philadelphia, Pa.
Bulldog. See Pittsburgh Corrugated Paper Box Co.
Campbell Paper Box Co., South Bend, Ind.
Consolidated Paper Co., Monroe, Mich.
Container Corp. of America, 111 W. Washington, Chicago.
Gair Co., Robert, 420 Lexington Ave., New York. (Boxes.)
Gator-Hide Kraft. See International Paper Co.
Hinde & Dauch Paper Co., 325 Decatur, Sandusky, Ohio.
Huntington Paper Box Co., Huntington, Ind.
International Paper Co., 100 E. 42nd, New York, N. Y.
Lake Lithographing Co., 2570 Superior Ave., Cleveland, O (Display Cartons.)
Mid-West Box Co., 111 W. Washington, Dept. 36, Chicago
National Folding Box Co., New Haven, Conn. (Cartons.)
Pittsburgh Corrugated Paper Box Co., Pittsburgh, Pa.
River Raisin Paper Co., Monroe, Mich.
Sefton Mfg. Co., 59 E. Madison, Chicago, Ill.
Shuttleworth Carton Co., 474 W. Broadway, New York.

BRACKETS, Instrument
For Suspending Meters to Station Switchboard.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

BRAIDING MACHINES. See Wire Manufacturing Machines.

BRASS TUBING. See Tubing, Brass and Copper.

BRASS, BRONZE AND COPPER
Sheet, Rod, Bar.
American Brass Co., 25 Broadway, New York, N. Y.
American Nickeloid Co., Peru, Ind.
Anaconda. See American Brass Co.
Baltimore Brass Co., 1212 Wicomico, Baltimore, Md.
Baltimore Copper Mills, (Div. of General Cable Corp.) Baltimore, Md.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Dallas Brass & Copper Co., 812 Orleans, Chicago, Ill.
Nickeloid. See American Nickeloid Co.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa. (Rods and Forgings.)

BREAKERS, Circuit. See Circuit Breakers.
BRIDGES, Wheatstone. See Instruments, Laboratory Standard.
BRONZE. See Brass, Bronze and Copper; also Castings.
BRONZE, Phosphor. See Phosphor Bronze.
BRONZE POWDER, Aluminum. See Aluminum.
BRUSH HOLDERS. See Brushes, Commutator.
BRUSHES, Carbon. See Brushes, Commutator.
Graphite. See Brushes, Commutator.
Metal Graphite. See Brushes, Commutator.

BRUSHES, COMMUTATOR
(Brushes, Brush Holders and Flexible Leads.)

Brush Holders	See H
Carbon, Graphite, Metal Graphite	See C
Flexible Leads and Pig Tails	See L
Sheet Metal	See S
Wire Gauze	See W

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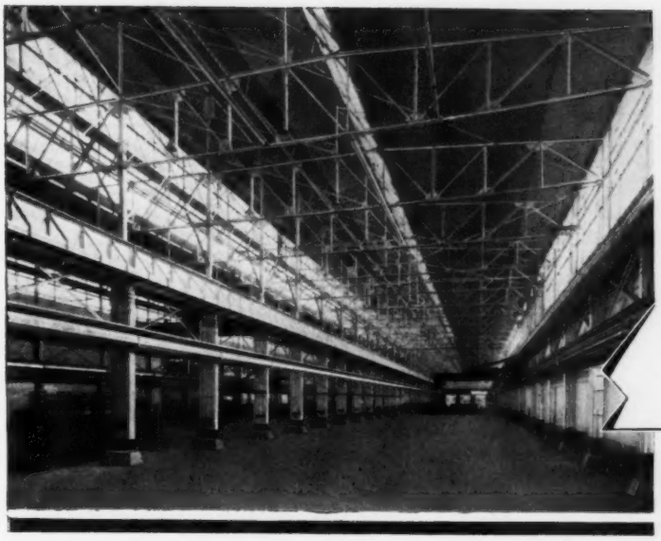

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Edgewood 284

BRUSHES, Commutator—Continued
Carenco. See Carbon Engineering Co.
Chapin Co., Chas. E., 227 Fulton St., New York, N. Y. ..... C W S .. L
Columbia Machine Wks., & M. I. Co., 263 Chestnut, Brooklyn, N. Y. ..... H ..
Cooley Mfg. Co., 98 Park Place, New York .. W .. .. ..
Diamond C. See Chapin Co., Chas. E.
Dixon Crucible Co., Joseph, Jersey City ....
Electra. See Automotive Mfg. Co.
Electric Accessories Co., 310 York Ave., Philadelphia, Pa. ..... H .
Electro-Nite Carbon Co., 308 N. Fourth, Philadelphia, Pa. ....
Eureka Copper Products Corp., North East, Pa. ..... W S H .
Fleck Carbon Co., 508 Broome, New York C .. .. ..
General Electric Co., Schenectady, N. Y. .... C .. .. H .
Graphalloy. See Graphite Metalizing Corp.
Graphite Metalizing Corp., 1040 Nepperhan Ave., Yonkers, N. Y. ..... C .. .. H ..
Henrite Products Co., 98 Park Place, New York, N. Y. ..... C .. ..
Holland Trolley Supply Co., 1623 E. 43rd, Cleveland, Ohio .... H ..
Jeandron, W. J., 345 Madison Ave., New York, N. Y. (Imported.) ..... C .. ..
Keystone Carbon Co., 4630 N. 11th, Philadelphia, Pa. ..... C .. ..
Kohlenite Products Co., 417 W. 28th, New York, N. Y. ..... C .. ..
Le Carbone. See Jeandron, W. J.
Le Valley Vitae Carbon Brush Co., 4851 Grand Central Terminal, New York, N. Y. C .. ..
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich. ..... C .. ..
Morganite Brush Co., 35-02 48th Ave., Long Island City, N. Y. ..... C .. ..
National Carbon Co., Cleveland, O. ..... C .. ..
New Process Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. ..... C L
No Spark. See Calebaugh Self-Lubricating.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, Ohio ..... C W L
Ohio Elec. Specialty Mfg. Co., Troy, O. .... .. W .. .. ..
Perfection Supply Co., 98 Park Pl., New York, N. Y. ..... C W S H L
Pittsburgh Carbon Brush Co., 127 Fancourt, Pittsburgh, Pa. ..... C .. ..
Pure Carbon Co., Wellsville, N. Y. ..... C W S .. L
Pyramid. See National Carbon Co.
Reaction. See Baylis Co.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y. .... W L
Salem Electrical Supply Co., Salem, Mass. .. W .. .. ..
Seabury, Ralph L., Factories Bldg., Toledo, O. C .. ..
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. ..... C .. ..
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y. ..... C L
Speer Carbon Co., St. Mary's, Pa. ..... C .. ..
Stackpole Carbon Co., St. Mary's, Pa. .... C .. ..
Sterling. See Carbon Laboratories Co.
Superior Carbon Products Co., North Rd., Poughkeepsie, N. Y. ..... C .. ..
U. S. Graphite Co., Saginaw, Mich. ..... C .. ..
Universal. See Graphite Metalizing Corp.
Weber Elec. Wks., Brooklyn Sta., Cleveland. C L
BRUSHES, PNEUMATIC SPRAYING. See Spraying Outfits.

BRUSHES FOR VACUUM CLEANERS

Omaha Brush Co., 320 N. 15th, Omaha, Neb. (Brushes rebristled.)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
BUGGIES, Armature. See Lifts, Armature.

BULBS, Glass

For Incandescent Lamps and Tubes.
Almo Mfg. Co., 38 Crawford, Newark, N. J.
Corning Glass Wks., Corning, N. Y.
Fayette Glass Bulb Co., 229 21st, Brooklyn, N. Y.
Libby Glass Co., Toledo, O.
BUNCHING MACHINES. See Wire Manufacturing Machines.
BUSHINGS, SHAFT. See Bearings and Bushings.

BUSHINGS, Box and Cabinet, Porcelain

Appleton Electric Co., 1704 Wellington Ave., Chicago, Ill.
Columbia Metal Box Co., 226 E. 144th St., New York, N. Y.
Harter. See Multi Elect. Mfg. Co.
Knox Porcelain Corp., Knoxville, Tenn.
Mineralac Electric Co., 25 N. Peoria, Chicago, Ill.
Multi Electric Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Nelson Elec. Co., Plant City, Fla.
CABINET GRILL CLOTH. See Cloth, Untreated.

CABINETS, Fibre

Diamond State Fibre Co., Bridgeport, Pa.
Vulcawood. See Diamond State Fibre Co.
CABINETS, Refrigerator. See Refrigerator Cabinets.

CABINETS, Sheet Steel

Stamped and Turned-up Boxes and Cabinets.
Acme Blow Pipe & Sheet Metal Wks., New Orleans, La.
Adam Electric Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Benjamin Elec. Co., 1378 E. 16th, Los Angeles, Cal.
Berks Engineering Co., Reading, Pa.
Berthold Elec. Co., Gus, 555 W. Monroe, Chicago, Ill.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
C. & P. Electric Wks., Springfield, Mass.
Cleveland Switchboard Co., 2925 E. 79th, Cleveland, O.
Coast Specialty Co., 72 E. Sixth, Portland, Ore.
Cole Metal Products Co., 33 Crescent, Long Island City.
Columbia Elec. Mfg. Co., 59 Columbus Sq., San Francisco, Cal.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Columbian Steel Tank Co., 1505 W. 12th, Kansas City, Mo.
Commercial Mfg. & Supply Co., 1443 Delaware St., Denver.

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Dowman Duzier Mfg. Co., 1314 Murphy Ave., S. W., Atlanta, Ga.
Electric Box & Switchboard Co., 500 S. Thorp, Chicago.
Electric Panelboard Co., 426 Exchange, Rochester, N. Y.
Electric Apparatus Co., 702 N. Halsted, Chicago, Ill.
Federal Steel Products Co., 2 Ave. L, Newark, N. J. (Polarized Boxes.)
Fouch Elec. Mfg. Co., 105 N. Ninth, Portland, Ore.
Greater New York Metal Box Co., Inc., 143 W. 19th, New York.
Green Elec. Co., 31 N. Water, Rochester, N. Y.
Gurney Sheet Metal Wks., 718 E. 4th, Long Beach, Cal.
Hauer, J. B., Driggs Ave. and N. 11th, Brooklyn, N. Y.
Holzer Sheet Metal Wks., Inc., New Orleans, La.
Hough Mfg. Co., 2520 24th, Detroit, Mich.
Isert Co., J. H., 1234 Rowan, Louisville, Ky.
Karp Metal Products Co., 129 30th, Brooklyn, N. Y.
Kirtland Elec. Construction Co., 34 Herkimer, Albany, N. Y.
Large-Dail Mfg. Co., 406 Cherry St., Philadelphia.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lexington Elec. Products Co., 419 E. 24th, New York, N. Y.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Mansfield Elec. Hardware Co., Longview Ave., Mansfield, O.
Metropolitan Elec. Co., 2014 First Ave., S., Seattle, Wash.
Metropolitan Elec. Products Co., Blvd. at 14th, Long Island City, N. Y.
Milwaukee Vault & Cabinet Co., 521 Market, Milwaukee.
Meaher, S. L., 1951 Lawrence, Denver, Colo.
National Metal Box Co., Van Dyke & Ferris Sts., Brooklyn.
Newman Elec. & Mfg. Co., Eau Claire, Wis.
Parr Metal Products Corp., 3519 41st, Long Island City, N. Y.
Penn Electrical Co., 35 Water, Irwin, Pa.
Powerlite Switchboard Co., 4149 E. 79th, Cleveland, O.
Rezloh. See Holzer Sheet Metal Works.
Robbins & Myers, Inc., Springfield, O.
Security. See Aurora Steel Products Co.
Standard Metal Box Corp., 950 Grand St., Brooklyn, N. Y.
Star Metal Box Co., 238 46th, Brooklyn, N. Y.
Superior Switchboard & Devices Co., 420 Schroyer Ave., Canton, O.
Tanner & Co., Wm. F., 511 S. Sharp, Baltimore, Md.
United Metal Box Co., 473 President, Brooklyn, N. Y.
United Sheet Metal Wks., 575 Howard, San Francisco.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Wurdack Elec. Mfg. Co., 4444 Clayton Ave., St. Louis, Mo.

CABINETS AND BOXES, Wood

Ampere. See Donehue Lumber Co.
Aston Cabinet Mfrs., 1223 W. Lake, Chicago, Ill.
Boehm Cabinet Co., J., 2216 W. 63rd St., Cleveland, O.
Buckeye Mfg. Co., Springfield, O.
Carolina Wood Products Co., Asheville, N. C.
Carrom Co., Ludington, Mich.
Caswell-Runyon Co., Huntington, Ind.
Cheney Piano Action Co., A. C., Castleton, N. Y.
Clinton Corp., 342 Madison Ave., New York, N. Y.
Corlieth Cabinet Mfg. Co., St. Mary's, Pa.
Cory Cabinet Corp., Springfield, Mo.
Deiker Co., Geo., Henderson, Ky.
Donehue Lumber Co., Smith and State, Perth Amboy, N. J.
Effein & Sons, Frederick, 44 Central Ave., Brooklyn, N. Y.
Empire-United Hat Block Co., 312 E. 22nd, New York.
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Excello Products Corp., 4836 W. 16th, Cicero, Ill.
Grand Rapids Furniture Co., Grand Rapids, Mich.
Harper Mfg. Co., Cassopolis, Mich.
Hickory Box Co., Hickory, N. C.
Hubbell, H. L., 59 Market Ave., N. W., Grand Rapids.
Interstate Woodworking Co., 46 Wooster, New York, N. Y.
Karpen. See Studner Bros.
King Mfg. Corp., Rano & Crowley, Buffalo, N. Y.
Klumpp Sons, John G., 13 Baxter, New York, N. Y.
National Cabinet Co., New Philadelphia, O.
New England Box Co., Greenfield, Mass.
Oneida Cabinet Corp., Oneida, N. Y.
Ottawa Furniture Co., Holland, Mich.
Pierson Co., 836 Cedar, Rockford, Ill.
Pooley Co., 16th & Indiana Ave., Philadelphia, Pa.
Radio Allied Mfrs. Corp., 1340 S. Michigan Ave., Chicago.
Radio Cabinet & Equipment Co., 1504 Vine, Philadelphia.
Radio Mfg. Co., Div. of Pilliod Lumber Co., Swanton, O.
Radio Master Corp., Bay City, Mich.
Red Lion Cabinet Co., Red Lion, Pa.
R. E. Z. Cabinet Co., 54 North, Boston, Mass.
Rockford Sales Corp., 206 Lexington Ave., New York, N. Y.
Schutz Bros., 153 Chambers, New York, N. Y.
Signal Elec. Mfg. Co., 1904 Broadway, Menominee, Mich.
Southern Toy Co., Hickory, N. C.
Specialty Display Case Co., Kendallville, Ind.
Stradivara Co., Coshocton, Ohio.
Stettner Phonograph Corp., 318 E. 75th, New York.

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156 East Buffalo St., Milwaukee, Wis.

Studner Bros., 67 W. 44th, New York, N. Y.
Superior Cabinet Corp., 206 Broadway, New York, N. Y.
Syracuse Screen & Grille Co., North Manchester, Ind.
Tessier Bros., 355 Bridge, Northampton, Mass. (Radio.)
Trenton Wood Specialty Co., Stokes Ave. and P. R. R., Trenton, N. J.
Udell Wks., 28th and Barnes Ave., Indianapolis, Ind.
West Box Co., 235 Liberty, Springfield, Mass.
CABLE ARMORING MACHINES. See Wire Manufacturing Machines.
CABLE TEST SETS. See Instruments, Portable and Switchboard.
CABLING MACHINES. See Wire Manufacturing Machines.

CANDLES, Fixture

Glass, Fibre Paper.
Brandywine Fibre Products Co., 1402 Walnut, Wilmington, Del.
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Fibro Products Co., New Bedford, Mass.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Seamless. See Fibro Products Co.
CANOPY (Canopies). See Fixture Fittings.
Insulators. See Insulators.
Switches. See Switches, Snap.
CAPACITORS, RADIO. See Radio Circuit Components.

CARBON, Powdered

Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
CARBONS, Battery. See Carbons.
Arc Light. See Carbons.

CARBONS

Battery Arc Light.
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.
Columbia. See National Carbon Co.
Daylight. See National Carbon Co.
Lessing Battery. See Blanck & Carrier Corp.
Nuernberg Battery. See Blanck & Carrier Corp.
National Carbon Co., Cleveland, Ohio.
Oretip. See National Carbon Co.
Silvertip. See National Carbon Co.
Speer Carbon Co., St. Mary's, Pa.
Stackpole Carbon Co., St. Mary's, Pa.
CARTONS. See Boxes and Wrappers.
CASEIN PLASTICS. See Molded Insulation.
CASES, Eliminator. See Cases, Eliminator.
Flashlight. See Cases, Flashlight.

CASES, Eliminator

Luna Tin Mfg. Co., 547 W. 21st, New York, N. Y.

CASES, Flashlight

Bridgeport Brass Co., 744 E. Main, Bridgeport, Conn.
Lincoln Fibre Specialty Co., Newport, Del.
St. Louis Paper Can & Tube Co., St. Louis, Mo.
Underwood Battery Co., 1250 Ontario, Cleveland, O.
CASTINGS, Aluminum. See Castings, Aluminum. Also Castings, Copper, etc.
Brass. See Castings.
Bronze. See Castings.
Copper. See Castings.
Die. See Castings, Die.
Monel Metal. See Castings.
Steel. See Castings, Steel.
White Metal. See Castings.

CASTINGS, Aluminum

Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Quality Aluminum Casting Co., Waukesha, Wis.
Veco Mfg. Co., South Norwalk, Conn.

CASTINGS

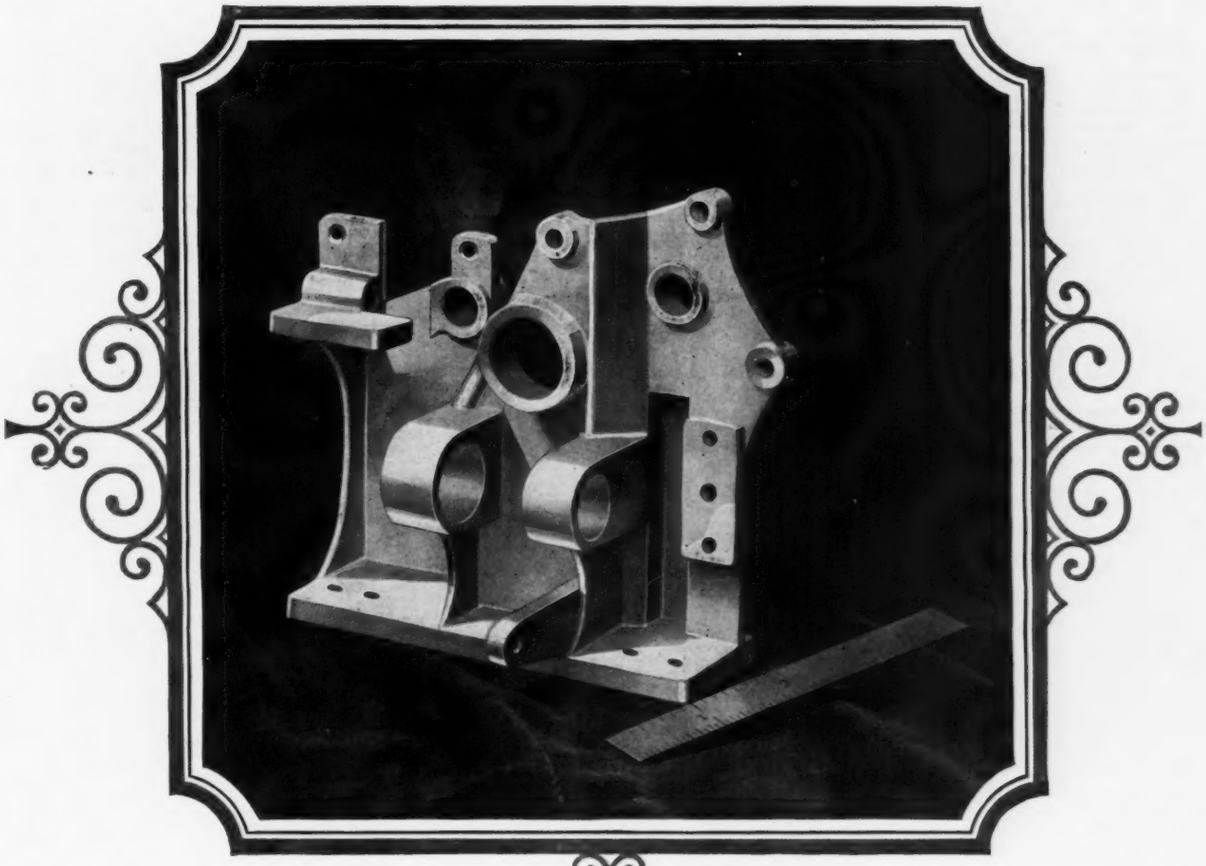
Copper, Brass, Bronze, Monel Metal, White Metal.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Central Pattern & Foundry Co., 3737 S. Sacramento Ave., Chicago, Ill.
Chase Brass & Copper Co., Waterbury, Conn.
Faries Mfg. Co., Decatur, Ill.
McGill Metal Co., Valparaiso, Ind.
Ohio Pattern Wks. & Fdy. Co., 2730 Spring Grove Ave., Cincinnati, O.
Rabun Bronze Foundry, 617 West Belgrave, Huntington Park, Cal.
Sterling Art Metal Wks., 40 Purvis, Long Island City, N. Y.

CASTINGS, Die

Advance Tool & Die Casting Co., 1654 Holton, Milwaukee, Wis.
Alemite Die-Casting & Mfg. Co., 2640 Belmont Ave., Chicago, Ill.
Allied Die-Casting Corp., Long Island City, N. Y.
Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Aluminum Industries, Inc., 2438 Beekman, Cincinnati, O.
American Die Casting Co., 2040 Dominick, Chicago, Ill.
Badger Die Casting Co., 156 East Buffalo, Milwaukee, Wis.
Barnhardt Bros. & Spindler, Monroe & Throop St., Chicago.
Do-Di. See Doehler Die Casting Co.
Doehler Die Casting Co., 386 Fourth Ave., New York, N. Y.
Franklin Die Casting Corp., 826 Gifford, Syracuse, N. Y.
Illinois Die Castings Co., 503 S. Jefferson, Chicago, Ill.
Milwaukee Die Casting Co., 289 Fourth, Milwaukee, Wis.
Newton Die Casting Corp., 146 Munson, New Haven, Conn.
Perfection Die Casting Corp., 406 Lakeside Ave., N. W., Cleveland, O.
Permite. See Aluminum Industries, Inc.
Stewart Die Casting Co., 4500 Fullerton Ave., Chicago, Ill.
Superior Die Casting Co., 875 E. 70th, Cleveland, Ohio.
Twin City Die Castings Co., Talmadge and 33rd Aves., S. E., Minneapolis, Minn. (White Metal).

CASTINGS, Gray Iron

American Engineering Co., Philadelphia, Pa.
Athens Foundry Co., Athens, Pa.
Barlow Foundry Co., 551 N. J. R. R. Ave., Newark, N. J.
Barnett Foundry Co., Newark, N. J.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.



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North Wales Mach. Foundry Co., North Wales, Pa.
Sacks Iron Foundry, L., 357 Wilson Ave., Newark, N. J.
Smead & Co., Pine St., Jersey City, N. J.
St. Louis Malleable Castings Co., 7701 N. Conduit Ave., St. Louis, Mo.

CASTINGS, Steel

Bonney-Floyd Co., Columbus, Ohio.
Eastern Steel Casting Co., Ave. L & Edward St., Newark, Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Riverside Steel Casting Co., Jacobus Ave., Kearney, N. J.

CEMENT, Commutator

Armstrong. See Electric Power Maintenance Co.
Conductalute. See Technical Products Co.
Early, Edward E., 1129 W. Fifth, N. W., Canton, O.
Electric Power Maintenance Co., 21 N. Third, Minneapolis.
Imperial. See Martindale Electric Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, O.
Mitchell Rand Mfg. Co., 19 Vesey, New York, N. Y.
Perce-Lute. See Perfection Supply Co.
Perfection Supply Co., 98 Park Pl., New York, N. Y.
Plas Mica Co., 26 St. Andrews Place, Yonkers, N. Y.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CEMENT, Liquid Porcelain

Airlox Rubber Co., 6807 N. Clark, Chicago, Ill.
Anchorlute. See Technical Products Co.
Carricite. See Airlox Rubber Co.
Fire Lute. See Technical Products Co.
Fuselli. See Airlox Rubber Co.
Insa-Lute. See Technical Products Co.
Okonite Co., Passaic, N. J.
Repairet Mfg. Co., Milwaukee, Wis.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Thermold. See Technical Products Co.

CHAIN, Chandelier (Faney). See Crystals, Chandelier.
CHAIN DRIVES. See Chain, Power Transmission.

CHAIN, Fixture

Acco. See American Chain Co.
American Chain Co., Bridgeport, Conn.
Chase Brass & Copper Co.
Eastern Chain Works, 309 E. 22nd St., New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Globe Metal Mfg. Co., 2122 E. Hazard, Philadelphia, Pa.
H. & O. Chain Co., So. Norwalk, Conn.
Newark Metal Mfg. Co., 22 S. 6th, Newark, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rodale Mfg. Co., 240 Hudson, New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Universal Metal Chain Co., 75 Clymer, Brooklyn, N. Y.

CHAIN, Power Transmission

Baldwin Chain & Mfg. Co., Worcester, Mass.
Boston Gear Wks. Sales Co., Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Reeves Pulley Co., Columbus, Ind.
Renold Boston. See Boston Gear Wks.
Union Chain & Mfg. Co., Sandusky, O.
Whitney Mfg. Co., Hartford, Conn.

CHAIN, Socket

American Ball Chain Works, 13 Wooster St., New York.
Bead Chain Mfg. Co., Bridgeport, Conn.
H. & O. Chain Co., South Norwalk, Conn.

CHANDELIER BEADS. See Crystals, Chandelier.
CHANDELIER CRYSTALS. See Crystals, Chandelier.
CHANDELIER FRINGE. See Crystals, Chandelier.

CHARGERS, Magnet

Charging, Remagnetizing.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Cowie Elec. Co., E. S., 1823 Wyandotte, Kansas City, Mo.
Fore Elec. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago.
Valley Electric Co., 4221 Forest Park Blvd., St. Louis, Mo.

CHEMICALS, Battery

Electrolyte, Battery Salts, Battery Oxides, Sal Ammoniac, Bluestone, Manganese.
Cooper & Co., Charles, 194 Worth, New York, N. Y.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago. (Oxide.)
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Electro Chemical Co., 113 W. Court St., Dayton, O.
General Metallic Oxides Co., Jersey City, N. J.
Globe Chemical Co., Murray Rd. and Big Four R. R., Cincinnati, O.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Kalbfleisch Corp., 200 5th Ave., New York, N. Y.
Klipstein Co., 644 Greenwich, New York, N. Y.
Merrimac Chemical Co., 148 State, Boston, Mass.
Powers-Weightman-Rosengarten Co., Philadelphia, Pa.
Voltah. See Powers-Weightman-Rosengarten Co.
Wah Chang Trading Corp., 233 Broadway, New York, N. Y.

CHEMICALS, Refrigeration

Ansul Chemical Co., Marinette, Wis.
Arctic. See Roessler & Hasslacher Chemical Co.
Carbide & Carbon Chemicals Corp., 30 E. 42nd, New York, N. Y. (Butane & Isobutane.)
Dry Ice Corp. of America, 50 E. 42nd, New York, N. Y.
Roessler & Hasslacher Chemical Co., 709 Sixth Ave., New York, N. Y. (Methyl Chloride, Ethyl Chloride.)
Virginia Smelting Co., West Norfolk, Va. (Sulphur Dioxide.)
Chromium Plating. See Plating & Finishing.

CHUCKS, Magnetic

J & H Elec. Co., 161 Clifford, Providence, R. I.
Simmons. See Taft-Pierce Mfg. Co.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S. (Rockdale), Worcester, Mass.

CIRCUIT BREAKERS

Air and Oil Circuit Breakers and Oil Break Switches.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Anderson Mfg Co., Albert & J. M., 239 A, Boston, Mass.
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Automatic Switch Co., 517 E. Larned, Detroit, Mich.
Burke Controller Co., 389 Lexington Ave., New York, N. Y.
Condit Elec'l Mfg. Corp., 833 Summer St. (South Boston), Boston, Mass.
Cramblett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
General Electric Co., Section W-232, Merchandise Dept., Bridgeport, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
H. & H. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Inducto-therm. See Allen-Bradley Co.
I. T. E. Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia, Pa.
Line Material Co., South Milwaukee, Wis. (Oil Switches.)
Maple Co., R. H., Indianapolis, Ind.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Minibraker. See Burke Controller Co.
Roller-Smith Co., 289 Broadway, New York, N. Y.
Sentinel. See Westinghouse Elec. & Mfg. Co.
Pakamine Corp., 208 Rawson, Long Island City, N. Y.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.

U-Re-Lite. See I. T. E. Circuit Breaker Co.
Ward Leonard Elec. Co., Mount-Vernon, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CIRCUIT TESTERS. See Testers, Fuse and Circuit.
CLEANER BAGS, Vacuum. See Bags, Vacuum Cleaner.
CLEANER BRUSHES, Vacuum. See Brushes for Vacuum Cleaners.

CLEANERS, Metal

Oakite Products, Inc., 26 Thames, New York, N. Y.

CLIPS, Fuse. See Fuse Clips.

CLIPS, Heater Plug

Gray Bros. Co., Piano, Ill.

CLOCK SWITCHES. See Switches, Time.
CLOTH GEARS. See Gears and Pinions, Composition.
CLOTH LOUD SPEAKER DIAPHRAGM. See Cloth, Untreated.
CLOTH RADIO GRILL. See Cloth, Untreated.

CLOTH, Untreated

Boyle & Co., John, 112 Duane, New York, N. Y.
Canvas, "Aeroplane Cloth," Cotton Duck, Drill, Diaphragm Cloth, Grill Fabrics, etc
Findall Fabrics Corp., 200 Madison Ave., New York, N. Y. (Grill Cloth).

CLOTH AND PAPER, Insulating

Cloth, Insulated	See C					
Paper, Insulated	See P					
Fibre Paper (Fish Paper)	See F					
Press Board (Fuller Board)	See B					
Silk	See S					
Acme Wire Co., New Haven, Conn.		C	S	P	.	.
Armco. See Rogers Paper Mfg. Co.						
Armatite. See Mica Insulator Co.						
Brand & Co., William, 268 4th Ave., New York				P	.	.
Campbellite. See Campbell Fibre Co.						
Campbell Fibre Co., Stanton, Delaware						B
Carboloid Products Corp., 15 Park Row, New York, N. Y.			C	.	P	.
Case Brothers, Inc., Highland, Park, Conn.				.	P	. B
Case Mfg. Co., Unionville, Conn.				.	P	. .
Case & Risley Press Paper Co., Oneco, Conn.						
C-F. See Campbell Fibre Co.						
Celoron Co., Bridgeport, Pa.				P	F	B
Chicago Mica Co., 345 Campbell, Valparaiso, Ind.			C			
Dexstar. See Dexter & Sons.						
Dexter & Sons, C. H., Windsor Locks, Conn. (Condenser Tissue.)						
Diamond State Fibre Co., Bridgeport, Pa.					P	
Dielectric Mfg. Co., St. Louis, Mo.		C	S	P	.	B
Electrite. See West Virginia Pulp & Paper Co.						
Fyberoid. See Wilmington Fibre Specialty Co.						
General Electric Co., Section W-232, Merchandise Dept., Bridgeport, Conn.		C	.	P	.	.
Hartford City Paper Co., Hartford City, Ind. (Glassine Condenser Tissue).						
Hewitt & Bros., C. B., 16 Ferry, New York		C	.	P	.	.
Hi-Tex. See Stevens Paper Mills.						
Incella. See Tarentum Paper Mills Co.						
Irvington Varnish & Insulator Co., Irvington, N. J.		C	S	P	.	.
Manning Paper Co., J. A., Troy, N. Y.						B
Mica Insulating Co., 200 Varick, New York		C	S	P	.	B
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.				P	.	.
National Vulcanized Fibre Co., Wilmington, Del.					F	.
New Jersey Wood Finishing Co., Woodbridge, N. J.			C	.	.	.
Ohmoid. See Wilmington Fibre Specialty Co.						
Old Hick. See Hewitt & Bros., C. B.						
Peerless. See National Vulcanized Fibre Co.						
Rogers Fibre Co., 210 Lincoln, Boston, Mass.					F	.
Rogers Paper Mfg. Co., South Manchester, Conn.						B
Schweitzer, Inc., Peter J., 200 Fifth Ave., New York, N. Y. (Condenser Tissue.)						
Seutan Co., 342 Madison Ave., New York				P	.	.
Sico. See Standard Insulation Co.						
Standard Insulation Co., Rutherford, N. J.		C	S	P	.	.
Sterling Fireboard Co., 501 Fifth Ave., New York. (Varied Hard Fibreboard)						B
Sterlite. See Sterling Firebrand Co.						
Stevens Paper Mills, Windsor, Conn.						B
Tarentum Paper Mills Co., Tarentum, Pa.				P	.	.
Turbenite. See Brand & Co., Wm.						
Union Mills Paper Mfg. Co., New Hope, Pa.				P	.	.
Warren Mfg. Co., 342 Madison Ave., New York, N. Y.				P	.	.
West Virginia Pulp & Paper Co., 200 5th Ave., New York						B
Wilmington Fibre Specialty Co., Wilmington, Del.				P	.	.

CLUTCHES, Magnetic

Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.

COIL (Coils).

Armature and Field. See Coils, Finished.
Choke (Power). See Fittings, High Tension.
Choke (Radio). See Radio Circuit Components.
Driers & Impregnators. See Ovens.
Electromagnet. See Coils, Finished.
Flatteners. See Rolls, Coil Flattening.
High Frequency. See Electro-Therapeutic; also Radio Circuit Components; also Ignition Outfits.
Impregnators, Vacuum. See Ovens, Industrial.
Induction. See Coils, Finished; also Electro-Therapeutic.
Loop Benders. See Benders, Coil Loop.
Medical. See Electro-Therapeutic.
Presses. See Presses, Armature Coil.
Radio. See Radio Circuit Components.
Removers. See Removers, Coil.
Resistance. See Units, Rods & Grids; also Radio Circuit Components.
Shaping Machines. See Shaping Machines, Coil.
Spark. See Ignition Outfits.
Spreaders. See Winding Machines, Armature & Field Coil.
Taping Machines. See Taping Machines, Coil.
Tesla. See Ignition Outfits.
Testers. See Testers, Coil; also Test Benches, Armature.
Winders, Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Winders, Induction Coil. See Winding Machines, Industrial Coil.
Winding Forms. See Forms, Coil Winding.
Windings (Magnets). See Coils, Finished.
Wire Tension Devices. See Tension Devices, Coil Wire.

COILS, Finished

Armature, Field, Electromagnet and Induction Coils.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Auth Electrical Specialty Co., 422 E. 53rd St., New York.
A. & A. See Electrical Coil Winding Co.
Belden Mfg. Co., 2210B S. Western Ave., Chicago, Ill.
Bunnell & Co., J. H., 32 Park Place, New York, N. Y.
Burke Controller Co., 389 Lexington Ave., New York, N. Y.
Cameron Elec. Mfg. Co., Ansonia, Conn.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne,

Easton Coil Co., Easton, Pa.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electrical Coil Winding Co., 27th & Sanderson Sts., Camden,
Electrical Products Mfg. Co., Providence, R. I.
Irvington Varnish & Insulator Co., Irvington, N. J.
Marion Elec. Mfg. Co., 24 Cliff, Jersey City, N. J.
Modern Elec Mfg. Co., 312 Mulberry, Toledo, Ohio.
National Elec. Corp., 226 High, Newark, N. J.
Pifer Elec. Repair & Mfg. Co., 3610 Superior Ave., Cleveland, O.
Polymet Mfg. Co., 599 Broadway, New York, N. Y.
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Robertson, Leo F., 536 West 22nd St., New York, N. Y.
Sevison Magneto Engrg. Co., 397 Phillips, Toledo, O.
Stuns & Barron, 210 E. Pratt, Baltimore, Md.
Toledo Standard Commutator Co., 2242 Smead Ave., Toledo, O.
Universal Winding Co., Boston, Mass.
U. S. Armature Service Co., 1617 S. Michigan Ave., Chicago, Ill.
Varley Duplex Magnet Co., 15 Exchange Place, Jersey City, N. J. (Electromagnetic only).
Whittier & Ditmar, Inc., 1611 Beacon, Brookline, Mass.

COMMUTATOR

Bars. See Bars, Commutator.
Cement. See Cement, Commutator.
Dressers. See Stones, Commutator.
Lubricants. See Compounds, Commutator.
New. See Commutators.
Refilled. See Repairing and Second Hand.
Slotters. See Slotting Machines & Tools, Commutator.
Slotting Files. See Files, Commutator Slotting.
Soldering Machines. See Soldering Machines, Commutator.
Stones. See Stones, Commutator.
Tighteners. See Tighteners, Commutator.
Truing Devices. See Tools, Commutator Truing.

COMMUTATORS

Derby Commutator Co., Derby, Conn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., Cleveland, Ohio.

COMMUTATOR BRUSHES. See Brushes, Commutator.
COMPOSITION PULLEYS. See Pulleys, Composition.
COMPOUNDS, Sealing. See Wax and Compounds.

CONDENSER UNITS, Refrigerator

Bush Mfg. Co., Hartford, Conn.
McCord Radiator & Mfg. Co., Riopelle & E. Grand Ave., Detroit, Mich.
Rome-Turney Radiator Co., Rome, N. Y.

CONDENSERS, Radio. See Radio Circuit Components.
CONDENSER TUBING. See Tubing, Brass and Copper.
CONTACT POINTS. See Points, Contact.
CONTAINERS, Shipping. See Fibre Board Products.

CONTROLLERS, Motor

Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Anderson & Co., C. J., 212 W. Austin, Chicago, Ill.
Automatic Switch Co., 154 Grand, New York, N. Y.
Betts, Inc., James H., 1393 Sedgwick Ave., New York, N. Y. (Traffic.)
Burke Controller Co., 389 Lexington Ave., New York, N. Y.
B-G Oil Burner Co., Stockton, Cal.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Condit Elec'l Mfg. Corp., 833 Summer St. (South Boston), Boston, Mass.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dinkey. See Elec. Controller & Mfg. Co.
E C & M Youngstown. See Electric Controller & Mfg. Co.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electrite. See Sundh Elec. Co.
Diamond Elec. Mfg. Co., 1330 N. 16th, Los Angeles, Cal.
General Electric Co., Schenectady, N. Y.
Horni Signal Mfg. Corp., 515 Greenwich, New York, N. Y.
Industrial Controller Co., S. Pierce & Hanover, Milwaukee, Wis.
Malmin Co., H., 251 W. 19th, New York. (Sewing Machines.)
Monitor Controller Co., 51 Gay, Baltimore, Md.
National Electric Controller Co., 5315 Ravenswood Ave., Chicago, Ill.
Refrigerating Specialties Co., 723 S. Sacramento Blvd., Chicago, Ill.
Rowan Controller Co., 306 N. Holliday, Baltimore, Md.
Square D Co., 6060 Rivard, Detroit, Mich.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Swicholone. See Condit Elec. Mfg. Co.
Thermaload. See Monitor Controller Co.
Trumbull Electric Mfg. Co., Plainville, Conn.
Uemco. See Union Elec. Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
W. K. See Westinghouse Elec. & Mfg. Co.

COPPER. See Brass, Bronze and Copper; also Castings
COPPER TUBING. See Tubing, Brass and Copper.
CORD TIPS. See Tips, Cord.

CORES, RESISTANCE COIL (Lava)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Crescent. See M. Kirchberger & Co.
Ex-El-Co. See Southern Lava Co.
Kirchberger & Co., M., 1425 37th, Brooklyn, N. Y.
Lavite. See Steward Mfg. Co.
Lavarock. See M. Kirchberger & Co.
Southern Lava Co., Rossville, Ga.
Steward Mfg. Co., D. M., Chattanooga, Tenn.
Tennessee Burner Mfg. Co., Chattanooga, Tenn.
XL. See Tennessee Burner Mfg. Co.

CORES, RESISTANCE COIL (Refractory Porcelain)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Colonial Insulator Co., Akron, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Elemite. See Louthan Mfg. Co.
Pireite. See Hartford Faience Co.
Hartford Faience Co., Hartford, Conn.
Louthan Mfg. Co., E. Liverpool, O.
Thermal Syndicate, 58 Schenectady Ave., Brooklyn, N. Y.
Vitrecoil. See Thermal Syndicate.

COTTON DUCK. See Cloth, Untreated.
COTTON SLEEVING. See Tape, Cotton.
COUNTERS, Revolution. See Tachometers.

COUPLINGS, Shaft (Flexible-Insulated)

Bartlett Hayward Co., Baltimore, Md.
Bond Co., Charles, 617 Arch, Philadelphia, Pa.
Delbee Rubber Co., Syracuse, N. Y.
Falk Corp., Milwaukee, Wis.
Franke. See Smith & Serrell.
General Electric Co., Schenectady, N. Y.
Grundy. See Bond Co.
Lipe, W. C., Syracuse, N. Y.
Lovejoy Tool Wks., 319 W. Ohio, Chicago, Ill.
Mather. See Bond Co.
Nuttall Co., R. D., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Oneida. See Delbee Rubber Co.
Smith & Serrell, 24 Washington Pl., Newark, N. J.
Webster Mfg. Co., 1856 N. Kostner Ave., Chicago, Ill.

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Wood's Sons Co., T. B., Chambersburg, Pa.
COVERING MACHINES, WIRE. See Wire Manufacturing Machines.

CUPS, Grease
Bowen Products Corp., Auburn, New York.
Lunkenheimer Co., Cincinnati, Ohio.
CUT OUTS, Battery. See Switches, Battery.
CUTTING OUTFITS, Metal. See Welding and Cutting Outfits.
CRANES, Floor. See Lifts, Armature.

CRYSTALS, Chandelier
Crystals, Prisms, Beads, Chains, Fringes.
Crystal Venezia. See Harrison & Co., Arthur.
Friedlaender Co., 49 W. 23rd, New York, N. Y.
Harrison & Co., Arthur, 561 W. Washington Blvd., Chicago.
Hirschberg, Shutz & Co., 388 4th Ave., New York, N. Y (Fringe.)
Nelson Bead Co., 15 W. 37th, New York, N. Y. (Importer.)
Rialto Import Co., 112 W. 4th, New York, N. Y.
Schwartz Lighting Fixture Wks., 1341 Noble, Philadelphia
Wyle & Bros., J. J., 20 E. 27th, New York, N. Y.
CURRENT INDICATORS. See Instruments, Pocket.
DASHBOARD METERS. See Instruments, Portable and Switchboard.

DECALCOMANIA
Meyercord Co., 133 W. Washington, Chicago, Ill.
Novar. See Palm Fechteler & Co.
Palm Fechteler & Co., 67 5th Ave., New York, N. Y.

DIALS
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts
Enameled. See Dials, Enameled.

DIALS, Enameled
Whittier Co., Horace B., Pequabuck, Conn.
DIAPHRAGM, Cloth. See Cloth, Untreated.
DIE CASTINGS. See Castings, Die.
DIE MAKERS. See Dies, Die Makers.
DIES, Pipe. See Stocks, Dies and Reamers.

DIES, DIE MAKERS
Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Donly Machine Specialties Co., 2104 S. 52nd Ave., Chicago, Ill.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Mareck & Nebel, 255 Greenwich, New York, N. Y.

DISCS, Armature
Steel Discs, Laminations, and Segments for Motors and Transformers.
American Stamping Co., 978 E. 64th, Cleveland, O.
Cleveland Armature Works, 4732 St. Clair Ave., Cleveland
Hercules Elec. Steel Corp., 145 Lafayette, New York, N. Y
Lamination Stamping Co., 764 Windsor, Hartford, Conn.
DRAWING MACHINES, WIRE. See Wire Drawing Machines.
DRIVE SCREWS. See Screws, Drive.
DRIVES, CHAIN. See Chain, Power Transmission.

DYNAMOMETERS
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co. Schenectady,
EBONITE. See Rubber, Hard.
ELECTROLYTE. See Chemicals, Battery.
ELECTROMAGNETS. See Coils, Finished.

ELECTRODES FOR GAS SIGNS
American Neon Light & Sign Corp., 625 Sixth Ave., New York, N. Y.
Eisler Engineering Co., 756 S. 13th, Newark, N. J.
Manhattan Elecl. Supply Co., 17 Park Place, New York, N. Y.
ELECTRODYNAMOMETERS. See Instruments, Laboratory Standard.
ELEMENTS, Heating. See Units, Rods and Grids.

ENAMELING MACHINES (For Magnet Wire)
(See Also Wire Manufacturing Machines).
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.

ENGRAVING MACHINES
Portable Bench and Pedestal Outfits for Marking Metal.
Brewster Co., Wm., 30 Church, New York, N. Y.
Deckel. See Preis & Co., Inc., H. P.
Engravograph Corp., 12 Vestry, New York, N. Y.
Etchograph. See Brewster Co., Wm.
Gilbert Supply Co., Independence, Iowa.
Gorton Machine Co., Geo., Racine, Wis.
Preis & Co., Inc., H. P. Newark, N. J.

ENGRAVING, Radio Panel
Engraving to Order.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa
Eisler Engineering Co., 756 S. 13th, Newark, N. J. (Tube Base Branders).
Etch-O-Gravure. See Insuline Corp. of America.
General Fabricating Co., 165 Greenwich, New York, N. Y.
Globe Mfg. Co., 101 Spokane St., Seattle, Wash.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
New England Products Co., 232 Greenwich, New York.
Preis & Co., Inc., H. P., 227 Fulton, New York, N. Y.
Schwenke Machine Engraving Co., 2036 Woodward Ave., Detroit, Mich.
Verichrome Laboratories, 4614 Spring Grove Ave., Cincinnati,
Wright Radio Co., 114 Exchange, Rockland, Mass.

EYELETS
Platt Bros. & Co., Waterbury, Conn.
Waterbury Brass Goods Co., Waterbury, Conn.
Waterbury Button Co., 835 S. Main, Waterbury, Conn.
FABRIC, Radio Grill. See Cloth, Untreated.
FABRIC SHADES. See Shades, Fabric.
FAN BLADES. See Blades, Fan.
FEET, FELT. See Felt.

FELT
Advance Felt & Cutting Co., 317½ S. Jefferson, Chicago.
American Felt Co., 211 Congress, Boston, Mass.
Booth Felt Co., 460 18th, Brooklyn, N. Y.
Brawley, T. R., 279 20th, Brooklyn, N. Y.
Western Felt Wks., 4029 Ogden Ave., Chicago, Ill.

FERRULES
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, 490 Hancock Ave., Bridgeport, Conn.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Massachusetts Machine Shop, Inc., Boston, Mass.
Patton-MacGuyer Co., Providence, R. I.
Platt Bros. & Co., Waterbury, Conn.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., 99 Mill, Waterbury, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.

FIBRE BOARD PRODUCTS (Solid and Corrugated)
Container Corp. of America, 111 W. Washington, Dept. 36, Chicago, Ill.
Mid-West Box Co., 111 W. Washington, Chicago.
Sefton Mfg. Corp., 59 E. Madison, Chicago, Ill.
FIBER CANDLES. See Candles, Fixture.
FIBRE GEARS. See Gears and Pinions, Composition.
Paper. See Cloth and Paper.
Radio Panels. See Radio Molded Parts.
Shipping Containers. See Fibre Board Products.
Vulcanized. See Fibre, Vulcanized.

FIBRE, Phenol
Moisture Proof; Sheet, Rod, Tubes.
Armite. See Spaulding Fibre Co.
Bakelite-Dilecto. See Continental Fibre Co.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Campbellite. See Campbell Fibre Co.
Celoron Co., Bridgeport, Pa.
Continental Fibre Co., Newark, Del.
Fibroc Insulation Co., 245 Lincoln Ave., Valparaiso, Ind.
Formica Insulation Co., 4628 Spring Grove Ave., Cincinnati, O.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Phenolite. See National Vulcanized Fibre Co.
Spaulding Fibre Co., Inc., Tonawanda, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

FIBRE, Vulcanized
Sheet, Rod, Tube, Horn, Fibre, Bushings, Washers, Cleats, Screw Machine Products.
Brandywine Fibre Products Co., 1402 Walnut St., Wilmington, Del.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Conite. See Continental Fibre Co.
Continental Fibre Co., Newark, Del.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond F. See Diamond State Fibre Co.
Diamond State Fibre Co., Bridgeport, Pa.
Egyptian. See Delaware Hard Fibre Co.
Electrosote. See Pantasote Co.
Fibro Products Co., New Bedford, Mass.
Fyberoid. See Wilmington Fibre Specialty Co.
Independent Laboratories, 50 E. 42nd, New York, N. Y.
Iten Fibre Co., 5403 Bower Ave., Cleveland, O.
Leatheroid. See Rogers Fibre Co.
Lincoln Fibre & Specialty Co., Newport, Del.
National Vulcanized Fibre Co., Wilmington, Del.
Ohmoid. See Wilmington Fibre Specialty Co.
Pantasote Co. Inc., 250 Park Ave., New York, N. Y.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass.
Spaulding Fibre Co., Tonawanda, N. Y.
Standard Fibre Products Co., 36 Pleasant, Watertown, Mass.
Vul-Cot. See National Vulcanized Fibre Co.
Vulcawood. See Diamond State Fibre Co.
Wilmington Fibre Specialty Co., Wilmington, Del.
FIBRE WASHERS. See Fibre.
FIELD COILS. See Coils, Finished.

FILAMENTS, Incandescent Lamp
Conneway Elec. Laboratories, 406 Jefferson St., Hoboken.
Filament Supply Co., 1317 Willow Ave., Hoboken, N. J.
Suter & Nuetzi, 3709½ Lisbon Ave., Milwaukee, Wis.
Vacuum Tube Products, Steneck Trust Bldg., Hoboken, N. J.
Volkmar & Sons, 187 Sylvan Ave., Newark, N. J. (Lead-in-Welds.)

FILES, Commutator Slotting
Ideal Commutator Dresser Co., 1008 Park, Sycamore, Ill.
Martindale Electric Co., 1264 W. Fourth, Cleveland, O.
FISH PAPER. See Cloth and Paper.
FITTINGS, Fixture. See Fixture Fittings.
FIXTURE CANDLES. See Candles, Fixture.
FIXTURE CHAIN. See Chain, Fixture.
FIXTURE, Cellars. See Fixture Fittings.

FIXTURE FITTINGS

	KEY
Bowl Holders	See B
Brass Fittings	See B
Canopies	See B
Collars	See B
Crow Feet	See I
Finials (Brass, Glass and Porcelain)	See B
Hangers	See H
Hickies, Brass	See B
Hickies, Iron	See I
Hooks, Brass	See B
Hooks, Iron	See I
Iron Fittings	See I
Loops, Brass	See B
Loops, Iron	See I
Rings	See B
Shade Holders	See S
Shells	See B
Spinnings	See B
Stampings	See B
Stems	See B
Straps	See H
Studs	See I

Acme Lighting Products, Inc., 2114 Woodland Ave., Cleveland, O. Straps ..... H
American Chain Co., Bridgeport, Conn. (Loops and Rings.) ..... B
American Ring Co., Waterbury, Conn. (Candle.) ..... S
Appleton Electric Co., 1703 Wellington Ave., Chicago, Ill. ..... B I
Arco. See American Ring Co.
Arrow Electric Division of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn ..... S
Artoloid. See Great Eastern Brass Wks., Inc.
Art Metal Co., 3721 Dayton, Cleveland, O. ..... H
Banlite. See East Side Metal Spinning Co.
Banner. See Plume & Atwood Mfg. Co.
Barton Brass Wks., 3627 Superior, Detroit. ..... B
Belmet. See B. & L. Metal Stamping Co.
Bloch Bros., 88 Walker, New York ..... B
Brandt Mfg. Co., 3727 Gratiot Ave., Detroit. B
Braun, J. G., 600 S. Pauline, Chicago, Ill. (Pressed Ornaments.) ..... B I
B. & L. Metal Stamping Co., 250 Moore, Brooklyn, N. Y. (Also Combination Wall Bracket Hanger.) ..... B I H

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Cambridge Brass Co., Cambridge, Mass. ..... B
Chase Brass & Copper Co., Waterbury, Conn. B .. S ..
Cleaneezy. See Dunlap Co.
Colonial Stamping Co., Brill St. & Passaic Ave., Newark, N. J. ..... B .. S ..
Crescent Brass Mfg. Co., Reading, Pa. ..... B
Crouse-Hinds, Solvay Sta., Syracuse, N. Y. ..... S H
Diamond Needle & Mfg. Co., Torrington, Conn. (Hickies.) I
Dunlap Co., John, Carnegie, Pa. ..... S
East Side Metal Spinning Co., 451 Greenwich, New York, N. Y. ..... B
Eureka Tin Ware Mfg. Co., 135 W. 20th, New York, N. Y. ..... S
E-Z Up. See Plume & Atwood Mfg. Co.
Faries Mfg. Co., Decatur, Ill. ..... B I S H
Flaherty Co., M. E., 28 S. Clinton, Chicago. I
Fralick Co., S. R., 15 S. Clinton, Chicago. I
Franklin Brass Foundry Co., Reading, Pa. ..... B
Friedley-Voshardt Co., Chicago. ..... B
Grabler Mfg. Co., 6565 Broadway, S. E., Cleveland, O. I
Great Eastern Brass Wks., Inc., 182 Grand, New York, N. Y. (Spindles).
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... S
Incandescent Supply Co., 468 West Broadway, New York, N. Y. ..... B H
Isco. See Incandescent Supply Co.
Jiffy. See White Mfg. Co., J. H.
Kwikon. See Fralick Co., S. R.
Lakin. See Thomas & Betts Co.
Liberty Brass Turning Co., 88 Walker, New York, N. Y. I
Liberty Iron Pipe & Nipple Works, 62 Greene, New York, N. Y. ..... B I
Liberty Machine Co., Wauwatosa, Wis. ..... B I
Light Metal Stamping Co., 310 13th St., West New York, N. J. ..... S
L & K Mfg. Co. 440 Adelphi, Brooklyn, N. Y. ..... H
L. & W. Brass Wks., 820 Orleans, Chicago, Ill. B
Madelite. See Belson Mfg. Co.
M. S. W. Mfg. Co., 1527 Niagara Ave., Buffalo, N. Y. I
Metal Products Co., 210 Canal, New York. ..... B
Metro Iron Ornament Co., 191 Christie, New York, N. Y. I
Metropolitan-Columbia Mfg. Co., 714 Metropolitan Ave., Brooklyn, N. Y. ..... B
Midwest Elec. Co., 1639 Walnut, Chicago, Ill. I
Mid-West Chandelier Co., 14th & Chestnut Sts., Kansas City, Mo. ..... B
Michell-Vance Co., 70 Washington, Brooklyn, N. Y. ..... S
Monarch. See Perfecilite Co.
Murlin Mfg. Co., Philadelphia, Pa. ..... B I
National Electric Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa. (Studs.) I
New Era Elec. Mfg. Co., 6725 Machinery Ave., N. E., Cleveland, O. ..... H
New Wrinkle. See Bryant Elec. Co.
New York Brass Turning Co., 568 Broadway, New York, N. Y. ..... B
Noboit. See Fralick & Co., S. R.
N. W. Cleat Receptacle Bracket, 2437 N. 29th, Philadelphia, Pa. I
Onil. See Perfecilite Co.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. B .. S ..
Perfecilite Co., 1457 E. 40th, Cleveland. ..... S
Pittsburgh Valve & Fittings Co., Barberton, O. .. I
Plume & Atwood Mfg. Co., Waterbury, Conn. B .. S H
Plumwood. See Plume & Atwood Mfg. Co.
Plymouth. See Vester Sons, Alfred.
Reading Brass Co., 141 Schiller, Reading, Pa. B I
Ribaysen Mfg. Co., J., 952 W. Lake, Chicago, Ill. B
Rockale Mfg. Co., 200 Hudson, New York. ..... B H
Sandow Tool Co., 1440 Bway, New York, N. Y. .. S
Scovill Mfg. Co. Waterbury, Conn. ..... B I
Simpalite. See Sprecher Mfg. Co., P. W.
Simplex. See Plume & Atwood Mfg. Co.
Springfast. See Plume & Atwood Mfg. Co.
Square-G. See Grabler Mfg. Co.
Standard Snap-Lite Corp., 504 Jackson Ave., Long Island City, N. Y. ..... S
Standard Metal Spinning Co., 128 Mott, New York, N. Y. ..... B
Star. See Perfecilite Co.
Star. See Steel City Elec. Co.
Steel City Elec. Co., Pittsburgh, Pa. I
Steele & Johnson Mfg. Co., Waterbury, Conn. B .. S ..
Stembridge, Tenny & Brandt, 29 S. Clinton, Chicago, Ill. (White Metal.) ..... B
Sterling Spinning & Stamping Wks., 476 Broome, New York, N. Y.
T. & B. See Thomas & Betts Co.
Thomas & Betts Co., 63 Vesey, New York. I
Uno. See Bryant Elec. Co., also Crouse-Hinds, also General Elec. Co., also Hart & Hegeman Mfg. Co., also Pass & Seymour.
United. See L & K Mfg. Co.
United Metal Spinning Co., 440 Adelphi, Brooklyn, N. Y. ..... B
Vester, Sons, Alfred, 5 Mason, Providence, R. I. B
Victor. See Plume & Atwood Mfg. Co.
Virden, Div. of Gill-Virden Co., 6108 Longfellow Ave., Cleveland, O. ..... B
Walden Tool & Metal Mfg. Co., New Haven Conn. .....
Wameco. See Waterbury Metal Wares Co.
Waterbury Co., Waterbury, Conn. ..... B
Waterbury Metal Wares Co., Waterbury, Conn. .. S ..
Weber Brass Co., Whitney Power Block, Cleveland, O. ..... B

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FIXTURE FITTING—Continued
White Diamond. See White Mfg. Co., J. H.
White Mfg. Co., J. H., 111 N. 3rd, Brooklyn, N. Y. ..... B . . S . .
Wilhite Machine Wks., 1245 S. Hope, Los Angeles, Cal. ..... B . . . . .

FLASHERS, Sign

Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.
Ajax. See Reynolds Spring Co.
A. & W. See General Outdoor Adv. Co.
Angelus. See Electric Sign Flasher Corp.
Betts, Inc., James H., 1393 Sedgwick Ave., New York. (Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.)
Betts & Betts Corp., 645 W. 43rd, New York, N. Y. (Motor Flashers.) (Thermal Flashers.) Flashing Plugs.)
California Sign Flasher Co., 280 Guttenberg, San Francisco Cal.
Commercial Elec. Co., 1203 E. Grant, Portland, Ore.
Cramblet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Diamond. See General Appliance Corp.
Dominic. See Kala-Flasher Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electric Sign Flasher Corp., 1826 W. 9th, Los Angeles, Cal.
Figuregram. See Reynolds Electric Co.
Flash O-Lite. See Betts, Inc., James H.
Flip-Flop. See Betts, Inc., James H.
Gem Engineering Co., Hempstead, N. Y.
Gacor. See General Appliance Corp.
General Appliance Corp., 120 8th, San Francisco, Cal. (Flasher Button.)
General Controler Co., 200 E. First, Dayton, O.
Grazier Elec'l Products Co., Johnstown, Pa.
Horni Signal Mfg. Co., 516 Greenwich, New York, N. Y.
Jimbetts. See Betts, Inc., James H.
Kala-Flasher Co., 344 N. Church, Kalamazoo, Mich.
Killark. See Betts & Betts Corp.
Kontroler. See General Controler Co.
Magnetic Sign Flasher Co., Seattle, Wash.
Mercury. See Betts, Inc., James H.
Opalume Sign System, Battle Creek, Mich.
Phelps Elec. Co., 29 S. Clinton, Chicago, Ill. (Motorless.)
Phoenix Products Co., Phoenix, N. Y.
Presto Products Co., 64 University Place, New York, N. Y. (Sockets and Plugs.)
Reco. See Reynolds Elec. Co.
Reynolds Elec. Co., 2650 W. Congress, Chicago, Ill.
Reynolds Spring Co., Jackson, Mich.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Ryan. See Phoenix Products Co.
Skedoodle. See Phelps Elec. Co.
Sokit. See Betts, Inc., James H.
Thermo-Wynk. See Betts & Betts Corp.
Vacu. See Betts & Betts Corp.
Veebar. See Betts, Inc., James H.
Way, Eugene W., Seattle, Wash.
Wood Electric Co., C. D., 565 Broadway, New York N. Y.
Woodwin. See Wood Elec. Co., C. D.
Wynk-A-Lyte. See Betts & Betts Corp.

FLASHLIGHT LENSES. See Lenses.
FLEXIBLE ARMS. See Tubing, Flexible Metallic.
FLEXIBLE LEADS, Commutator Brush. See Brushes, Commutator.

FLEXIBLE SHAFT MACHINES

(For shafting. See Tubing, Flexible Metallic.)
Strand & Co., N. A., 5001 N. Lincoln, Chicago, Ill.

FORGINGS, Non-Ferrous

Scovill Mfg. Co., Waterbury, Conn.

FORMS, Coil Winding

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, O.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Master. See Armature Coil Equipment Co.

FORMS, Wire

Forms and Frames for Shade Holders and Shades: Bending, Welding, Forming.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Arrow Wire Frame Corp., 344 E. 23rd, New York, N. Y.
Blake & Johnson Co., Waterbury, Conn.
Central Wire Frame Co., 154 E. 23rd, New York, N. Y. (Complete with socket, cord and plug.)
Chelsea Wire Wks., 675 Hudson, New York, N. Y.
Clark Metal Products Inc., 490 Hancock Ave., Bridgeport Conn.
Electro Weld Co., 70 Munroe, Lynn, Mass.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Jeschke Wire Specialty Wks., Crawfordsville, Ind.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Manhattan Wire Products Co., 398 First Ave., New York.
Murray Hill Wire Frame Co., 314 E. 32nd, New York, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.
Steinen & Co., 297 Washington, Newark, N. J.
Watral & Sons, 133 E. 16th, New York, N. Y.
Young Industries, Inc., L. A., Detroit, Mich.

FRAMES, Wire. See Forms, Wire.
FRICTION TAPE. See Tape, Rubber and Friction.
FRINGE, Chandelier. See Crystals, Chandelier.

FUSE CLIPS

Sherman Mfg. Co., H. B., Battle Creek, Mich.
Waterbury Brass Goods Co., Waterbury, Conn.

FUSE TESTERS. See Testers, Fuse and Circuit.

FUSES AND FUSE WIRE

KEY
Cartridge ..... See C
Plug ..... See P
Non-Refillable ..... See N
Refillable ..... See R
Open Link ..... See O
Fuse Wire ..... See O

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... P . . . . .
Arkless. See Economy Fuse Mfg. Co.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... P N . . .
Automatic Elec. Iron & Fuse Co., 215 S. American, Philadelphia, Pa. ..... P . . . . .
Blue Ribbon. See Royal Elec. Co.
Buss. See Bussman Mfg. Co.
Bussmann Mfg. Co., University & Jefferson Ave., St. Louis ..... C P N R O
Chase-Shawmut Co., Newburyport, Mass. .. C P N R O
Chicago Jefferson Fuse & Electric Co., 1505 W. 15th St., Chicago, Ill. ..... C P N R O
Clearite. See Economy Fuse & Mfg. Co.
Clear-Top. See Trico Fuse Mfg. Co.
Colorton. See Trico Fuse Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. (Automobile) ..... C . . N R . .
Cote Bros. Mfg. Co., 132 W. Lake, Chicago C P . . R . .
Crystal. See Royal Elec. Co.
Daum Fuse & Elec. Mfg. Co., 1157 Hodgkiss, Pittsburgh ..... C . . . . R . .
D. & W. See Graybar Electric Co.

Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... C P N R . .
Eco. See Economy Fuse & Mfg. Co.
Electric Fuseguard Co., Charlottesville, Va.. C P N R . .
Elliott Electric Co., Shreveport, La. ..... .
Gem. See Chicago-Jefferson Fuse & Electric
General Elec. Co., Section W-232, Merchandise Dept., Bridgeport, Conn. ..... C P N R . .
Graybar Electric Co., Graybar Bldg., Lexington Ave. and 43rd St., New York, N. Y. C . . . . .
Great Western Fuse Co., 415 Lexington Ave., New York, N. Y. ..... C . . . R . .
H. & H. See Hart & Hegeman.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... P . . R . .
Hudson Wire Co., Ossining, N. Y. ..... O
Kantark. See Trico Fuse Mfg. Co.
Kirkman Engrg. Co., 1 Dominick St., New York, N. Y. ..... C P N . . O
Littelfuse Laboratories, 1772 Wilson Ave., Chicago, Ill. (Low Capacity, Glass Enclosed, .025 to 2 Amp.) ..... .
Monarch Fuse Co., Jamestown, N. Y. ..... C . . N R . .
National. See Economy Fuse & Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Pierce Renewable Fuses, Inc., 752 Main, Buffalo, N. Y. ..... C P . . R . .
Platt Bros. & Co., Waterbury, Conn. ..... O
Powell, F. W., 119 W. Ohio, Pittsburgh .. . P . . R . .
Ree-Nu-It Elec. Co., New Bedford, Mass.. C P . . R . .
Rochester Re-Fill Fuse Co., 402 Cottage, Rochester, N. Y. ..... C . . . R . .
Royal Elec. Co., Chelsea Station, Boston.. . . P N . . .
Shawmut. See Chase-Shawmut Co.
Simplicity. See Cote Bros. Mfg. Co.
Six-in-One. See Industrial Engrg. Co.
Star Fuse Co., 235 Canal, New York, N. Y. C P . . R . .
Trico Fuse Mfg. Co., 1001 McKinley Ave., Milwaukee ..... C P N R . .
Union. See Chicago-Jefferson Fuse & Electric

GALVANIZING

Cattie & Bros., Joseph P., Gaul and Letterly Sts., Philadelphia, Pa.

GALVANOMETERS. See Instruments, Laboratory Standard.

GAS INERT

Helium Co., Louisville, Ky.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.

GASKETS, Rubber

Gutta Percha & Rubber Mfg. Co., 15 Park Row, New York.
Canfield Rubber Co., Bridgeport, Conn.

GAUZE BRUSHES, Wire. See Brushes, Commutator.
GEARS, Fibre. See Gears and Pinions, Composition.

GEARS (Speed Changing Units)

Cleveland Worm & Gear Co., Cleveland, Ohio.
Cullman Wheel Co., 1346 Altgild, Chicago, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Ill.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Jones Fdy. & Machine Co., W. A., Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Nuttall Co., R. D., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.
Smith, Winfield H., Springville, N. Y.

GEARS, Worm

Albaugh-Dover Mfg. Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Colburn Gear & Mfg. Co. (Norfolk Downs), Quincy, Mass.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.

GEARS AND PINIONS, Composition

Celoron Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Delaware.
Diamond State Fibre Co., Bridgeport, Pa.
Fabroil. See General Elec. Co.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago,
General Electric Co., Schenectady, N. Y.
Medart Co., St. Louis, Mo.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Stahl Gear Co., 1390 E. 40th, Cleveland, Ohio.
Stranahan Gear Co., Philadelphia, Pa.
Textoil. See General Electric Co.
Textolite. See General Electric Co.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND PINIONS, Iron and Steel

Earle Gear & Machine Co., Wayne Junction, Philadelphia.
Falk Corp., Milwaukee, Wis.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Medart Co., St. Louis, Mo.
Meisel Bros. Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Perkins Machine & Gear Co., 120 Circuit Ave., Springfield, Mass.
Permag. See Perkins Machine.
Pool Steel Gear & Pinion Co., Cincinnati, Ohio.

GEARS AND PINIONS, Rawhide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Gerdes & Co., 50 Church, New York, N. Y.
Syracuse Rawhide Mfg. Co., Syracuse, N. Y.
Western Rawhide & Belting Co., Milwaukee, Wis.

GENERATORS, Electroplating. See Plating Generators
GLASS BULBS. See Bulbs, Glass.
GLASS CANDLES. See Candles, Fixture.
GLASS LETTERS. See Letters, Sign.

GLASS for Electrical Purposes

Corning Glass Wks., Corning, N. Y.
Pyrex. See Corning Glass Wks.

GLASSWARE

Alba. See Macbeth-Evans Glass Co.
Amazon. See Gleason-Tiebout Glass Co.
Amelites. See Consolidated Lamp & Glass Co.
Apollo. See Gillinder Bros., Inc.
Ardmore. See Jeannette Shade & Novelty Co.
Aurene. See Corning Glass Co.
Aurora. See Consolidated Lamp & Glass Co.
Bayley Sons, 105 Vanderveer, Brooklyn, N. Y.
Beaumont Co., Morgantown, W. Va.
Bellova. See McFaddin & Co., H. G.
Blanco. See Gleason-Tiebout Glass Co.
Beryllite. See Plaut & Co., L.
Bostock Rhodes & Co., 11 N. Moore, New York, N. Y.
Camia. See Gleason-Tiebout Glass Co.
Carara. See Gleason-Tiebout Glass Co.

Celestialite. See Gleason-Tiebout Glass Co.
Chesler & Sons Co., J., 45 Varick Ave., Brooklyn, N. Y.
Clearcut. See Ivanhoe Division of Miller Co.
Colcite. See Corning Glass Co.
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Cora. See Consolidated Lamp & Glass Co.
Cora-Lites. See Consolidated Lamp & Glass Co.
Corning Glass Co., Corning, N. Y.
Cremax. See Macbeth-Evans Glass Co.
Crystal. See Phoenix Glass Co.
Daylite. See Wells Glass Co.
Decora. See Macbeth-Evans Glass Co.
Delica-White. See Kopp Glass, Inc.
Druid. See Ivanhoe Division of Miller Co.
Eagle Mfg. Co., Wellsburg, W. Va.
Emeralite. See McFaddin, H. G.
Equalite. See Bayley & Sons.
Erskine Glass & Mfg. Co., Wellsburg, W. Va.
Federal Light & Lens Corp., Star City, W. Va.
Florentine. See Gleason-Tiebout Glass Co.
Genco. See Ivanhoe Division of Miller Co.
Gillinder Bros., Inc., Port Jervis, N. Y.
Gillinder & Sons, Inc., Philadelphia, Pa.
Gleason-Tiebout Glass Co., 99 Commercial, Brooklyn, N. Y.
Gletieco. See Gleason-Tiebout Glass Co.
Havana. See Kopp Glass, Inc.
Hocking Glass Co., Lancaster, O.
Holophane Co., 342 Madison Ave., New York, N. Y.
Imperial Glass Co., Bellaire, O.
Inland Glass Works, Chicago, Ill.
Ivanhoe Division of Miller Co., Cleveland, Ohio.
Ivory. See Phoenix Glass Co.
Ivre. See Ivanhoe Division of Miller Co.
Jeannette Shade & Novelty Co., Jeannette, Pa.
Jefferson Glass Co., Follansbee, W. Va.
Kaufeld Glass & Ceramic Co., Star City, W. Va.
King-Tutankhamen. See Macbeth-Evans Glass Co.
Kopp Glass, Inc., Swissvale, Pa.
Lumina. See Hocking Glass Co.
MacBeth-Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa.
Magnolia. See Phoenix Glass Co.
McFaddin & Co., H. G., 38 Warren, New York, N. Y.
Melilite. See Gillinder & Sons, Inc.
Micro. See Gillinder & Sons, Inc.
Miller Co., Meriden, Conn.
Monax. See Macbeth-Evans Glass Co.
Moonstone. See Jefferson Glass Co.
N. B. G. See Gillinder & Sons, Inc.
N. U. Glass. See Gillinder & Sons, Inc.
Nebulite. See Gillinder & Sons, Inc.
Nemalite. See Gillinder & Sons, Inc.
Nitro-Glas. See Jefferson Glass Co.
Nuart. See Imperial Glass Co.
Nulite. See Consolidated Lamp & Glass Co.
Nutralux. See Kopp Glass, Inc.
Opalux. See Gleason-Tiebout Glass Co.
Opola. See Inland Glass Co.
Pastelle. See Consolidated Lamp & Glass Co.
Pearltone. See Inland Glass Co.
Persian. See Gillinder & Sons, Inc.
Phoenix Glass Co., 2300 Fifth Ave., New York, N. Y.
Pliabrasgo. See Kopp Glass, Inc.
Pittsburgh Cut Glass Co., Monaca, Pa.
Plaut & Co., L., 432 E. 23rd, New York, N. Y.
Poly-Case. See Gleason-Tiebout Glass Co.
Prestepal. See Gleason-Tiebout Glass Co.
Quezal Glass Mfg. Co., Fresh Pond Rd. and Metropolitan Ave., Brooklyn, N. Y.
Radiant. See Phoenix Glass Co.
Regent. See Ivanhoe Division of Miller Co.
Rezelle. See Ivanhoe Division of Miller Co.
Rosedora. See Consolidated Lamp & Glass Co.
Shade-O-Tone. See Consolidated Lamp & Glass Co.
Snow-White. See Inland Glass Works.
Soloman & Son, Inc., L., 199 Wooster, New York, N. Y.
Star Glass Co., Star City, W. Va.
Sudan. See Ivanhoe Division of Miller Co.
Thebian. See Macbeth-Evans Glass Co.
Translux. See Kopp Glass, Inc.
Trojan. See Ivanhoe Div. of Miller Co.
United Novelty Glass Mfg. Co., 121 Prince, New York, N. Y.
Utopia. See Kopp Glass, Inc.
Velaria. See Ivanhoe Division of Miller Co.
Vineland Flint Glass Wks., Vineland, N. J.
Wells Glass Co., Kokomo, Ind.
Williamsburg Flint Glass Co., 290 Broadway, New York.
Yural. See Ivanhoe Division of Miller Co.
Zanesville Mould Co., Zanesville, O.

GONGS, Unmounted Shells

Bevin Bros. Mfg. Co., East Hampton, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
East Hampton Bell Co., East Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
Hill Brass Co., M. N., East Hampton, Conn.
Liberty Bell Mfg. Co., Minerva, O.
Reiter, G. C., Canton, O.

GRAPHITE BEARINGS. See Bearings, Oil-less.
GRID LEAKS. See Radio Circuit Components.
GRIDS, Resistance. See Units, Rods and Grids.
GRILL CLOTH. See Cloth, Untreated.
GROMMETS. See Eyelets.
GROUND LOCATORS. See Instruments, Portable and Switchboard; also Testers, Coil.
GROWLERS, Armature. See Testers, Coil.

HANDLES, Wood; For Switches or Sad Irons

Allen, Chas. E., Pequabuck, Conn.
American Enamel Co., 20 Neville, Providence, R. I.
Bogert & Hopper, 225 Varick, New York, N. Y.
Estes & Son, E. B., 5844 Grand Central Terminal Bldg. New York, N. Y.
Fitchburg Enamel Co., Fitchburg, Mass.
Flanders Hardware Co., North Weare, N. H.
Fuller, J. J. Westfield, Mass.
Narragansett Mach. Co., Pawtucket, R. I.
National Wood Process, New Bedford, Mass.
Novelty Turning Co., Norway, Me.
Ober Mfg. Co., Chagrin Falls, O.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O.
Piqua Handle & Mfg. Co., Piqua, Ohio.
Royal Enamel Co., Fitchburg, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Stiles & Co., H. A., 174 Portland, Boston, Mass.
Stratton Mfg. Co., Stratton, Maine.
Sun Enamel Wks., Leominster, Mass.

HOLDERS, Brush. See Brushes, Commutator.
HOT WIRE METERS. See Instruments, Portable and Switchboard.
IMPREGNATING COMPOUNDS. See Wax and Compounds
IMPREGNATING, VACUUM. See Ovens, Industrial.
INCANDESCENT LAMP BULBS (Unfinished). See Bulbs, Glass.
INCANDESCENT LAMP FILAMENTS. See Filaments, Incandescent Lamp.

INDICATORS, Operation

Operation and Cost Indicators for Manager's Office.
Bristol Co., Waterbury, Conn. (Elapsed Time Recorder.)
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Production Meter Co., 1315 S. Wabash Ave., Chicago, Ill.

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SCRANTON has moulded itself into all industries in the past four decades, and served them in constantly improving production methods and moulding accuracy. A proof of this service is found in SCRANTON'S vast facilities, —the largest and newest-equipped moulding plants in the world. Successful experience with proven methods, plus modern machinery and ideas, make a sum total of satisfaction to all users of SCRANTON moulding. From the moulds,—which we make ourselves—to the finished castings, a microscopic check is kept on uniformity, accuracy and finish. The result will justify the confidence of the keenest electrical manufacturing executive; the economies in production you desire from the use of plastics are to be found in SCRANTON moulding above all others.

The materials we use are the ever-popular "BAKELITE"; and "PHENOLIC" and "LACANITE," two moulding compounds for specific uses. Our engineering staff offers the opportunity of consultation and advice on new problems; your specifications or blue prints will receive prompt and courteous attention.

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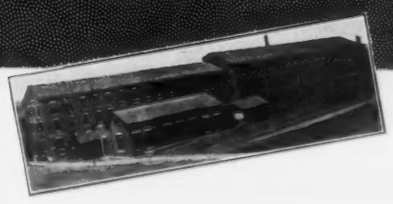

Auburn Plant, Auburn, New York

INDUCTION COILS. See Coils, Finished.
INSTRUMENT, Jewels. See Jewels.
INSTRUMENTS, Laboratory Standard. See Instruments Laboratory Standard.
INSTRUMENTS, Portable Testing. See Instruments, Portable and Switchboard; also Instruments, Pocket.

INSTRUMENTS, Laboratory Standard

Beck Bros., 3640 N. Second, Philadelphia, Pa.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Burt, R. C., 327 Michigan Ave., Pasadena, Cal. (Oscilloscopes.)
Cambridge Instrument Co., Ossining, N. Y.
Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill
Eppley Laboratory, Newport, R. I. (Standard Cells.)
Fahy. See Rubicon Co.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa
Hickok Elec'l Instrument Co., 10514 Dupont, Cleveland, O
Jagabi. See Biddle, James G.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill
Kason. See Rawson Elec'l. Instrument Co.
Kelvin. See Leeds & Northrup Co.
Kohlrausch. See Leeds & Northrup Co.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Millvay. See Chicago Apparatus Co.
Osiso. See Westinghouse Electric & Mfg. Co.
Radio Elec'l Wks., 50 W. 22nd, New York, N. Y.
Rawson Elec'l Instrument Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y
Rubicon Co., 29 N. Sixth, Philadelphia Pa. (Wheatstone Bridges, Galvanometers, Inductance Condensers, Potentiometers, Resistance Boxes, Permeameters.)
Simplex. See Leeds & Northrup Co.
Strobatchy. See Radio Elec'l Wks.
Thompson-Levering Co., 351 N. 57th St., Philadelphia, Pa
Vawter. See Thompson-Levering Co.
Unipivot. See Rawson Elec'l Inst. Co.
Vreeland Apparatus Co., 140 Cedar, New York, N. Y (Sine Wave Oscillators.)
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave Newark, N. J.

INSTRUMENTS, Pocket

Advance. See Eldredge Elec'l Corp.
Adbro Mfg. Co., 927 French, Pittsburgh, Pa.
Eclipse. See Eldredge Elec'l Corp.
Eldredge Elec'l Corp., 8 P. O. Sq., Springfield, Mass.
Ideal Instrument Co., Penacook, N. H.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Lundquist Tool & Mfg. Co., Worcester, Mass.
Milavolt. See Adbro Mfg. Co.
Readrite Meter Works, 7 College Ave., Bluffton, Ohio.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Shire Elec. Products Co., Marquette Bldg., Detroit, Mich
Shulder-Excel Mfg. Co., Clyde, Ohio.
Square D Company, Detroit, Mich.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave. Newark, N. J.
Wigginton. See Square D Company.
Yankee. See Lundquist Tool Mfg. Co.

INSTRUMENTS, Portable and Switchboard

This heading includes all standard, portable and switchboard types, measuring and testing instruments—ammeters, voltmeters, wattmeters, ohmmeters, cable testers and fault-finders.
See Also Instruments, Pocket; Also Instruments, Laboratory Standard.

Beck Bros., 421 Sedgley Ave., Philadelphia, Pa.
Beede Instrument Co., Penacook, N. H.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne and Windrim Sts., Philadelphia, Pa.
Cambridge Instrument Co., Ossining, N. Y.
Dongan Electric Mfg. Co., 2985 Franklin, Detroit, Mich
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa
Electric Mfg. Co., 966 Mission, San Francisco, Cal.
Esterline-Angus Co., Speedway, Indianapolis, Ind.
Fidelity Electric Co., Lancaster, Pa.
Fisher Cable Test Sets. See Leeds & Northrup.
Fore Elecl. Mfg. Co., 5255 Wabash Ave., St. Louis, Mo.
Freyn Engrg. Co., 310 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa
Ground-Ohmer. See Sticht & Co.
Handy. See Weinberg & Co.
Hickok Elecl. Inst. Co., 10514 Dupont, Cleveland, O.
Hoyt Elecl. Inst. Wks., 857 Boylston, Boston, Mass.
I T L. See Illinois Testing Laboratories.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Master. See Jewell Elecl. Instrument Co.
M. D. C. See Metropolitan Devices Corp.
Megger Testing Sets. See Biddle.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn
Multi-Volt Trouble Finder. See Welford, Jr., Geo. W.
Nagel Elecl. Co., W. G., 23 St. Clair, Toledo, Ohio.
Norton Elecl. Inst. Co., 81 Hilliard, Manchester, Conn.
Paneltest Meters. See Beede Instrument Co.
Peerless Meters. See Thompson-Levering Co.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Pin-Jack. See Weston Elec'l Instrument Co.
Price Hollister Co., Rockford, Ill.
Radio Electric Works, 150 West 22nd St., New York, N. Y.
Rawson Elecl. Inst. Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sangamo Elec. Co., Springfield, Ill.
Shortfinder. See Eisemann Shortfinder Co.
Standee. See Sticht Co., H. H.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Tanner Engrg. Co. Rawson St. and Nelson Ave., Long Island City, N. Y.
Test-A-Bat. See Beede Instrument Co.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thomson. See General Electric Co.
Triplex Meters. See Roller-Smith Co.
2 in 1. See Sticht & Co., H. H.
Two-in-One. See Sticht Co., Herman H.
United States Gauge Co., 44 Beaver, New York, N. Y.
Utility. See Esterline-Angus Co
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.

INSULATION (Insulating) (Insulators)

Beads. See Beads, Insulating.
Canopy. See Insulators, Canopy.
Cloth. See Cloth & Paper.
Composition. See Molded Insulation.
Compound. See Wax and Comp.
Fibre. See Fibre.
Lava. See Cores, Resistance Coil.
Marble. See Slate.
Mica. See Mica.
Molded. See Molded Insulation.
Paint. See Paint and Varnish.
Paper. See Cloth and Paper Insulating.
Phenolic. See Fibre, Phenol. Also Molded Insulation.

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Slate. See Slate.
Soapstone. See Soapstone.
Tubing. See Tubing, Varnished Fabrics.
Varnish. See Paint and Varnish.
Wax. See Wax and Compounds.

INSULATING MACHINES, WIRE. See Wire Manufacturing Machines.
INSULATING TUBING. See Tubing, Varnished Fabric; also Tubing, Rubber.

INSULATION CUTTERS

Artos Engrg. Co., Milwaukee, Wis.

INSULATION MIXERS

Baker Perkins Co., Saginaw, Mich.

INSULATION SHEARS. See Shears, Insulation.
INSULATION STRAINING MACHINES. See Wire Manufacturing Machines.
INSULATION TESTERS. See Instruments, Laboratory Standard.

INSULATORS, Canopy

Diamond State Fibre Co., Bridgeport, Pa.
General Electric Co., Schenectady, N. Y.
Knu. See Stanley, Arthur F.
Macallen Co., Boston 27, Mass.
Stanley, Arthur F. 150 Varick, New York, N. Y.
Wilmington Fibre Specialty Co., Wilmington, Del.

IRON CASTINGS. See Castings, Gray Iron.
IRONS, Soldering. See Soldering Irons.
JACKS, Armature. See Lifts, Armature.
JACKS, Radio. See Radio Receiver Parts.

JARS, Battery, Glass

For Composition Jars. See Molded Insulation; also Rubber.
Corning Glass Co., Corning, N. Y.
Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
Gillinder & Sons, Inc., Philadelphia, Pa.
Hazel-Atlas Glass Co., Wheeling, W. Va.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa.
Rodefer Glass Co., Bellaire, O.
Sneath Glass Co., Hartford City, Ind.
United States Glass Co., 9th & Bingham, Pittsburgh, Pa.

JEWELS, Instrument Bearing

Bird, Richard H., Waltham, Mass.
Deknatel & Sons, J. A., Queens Village, N. Y.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Fisher, Thomas E., Penacook N. H.
Gatti, Inc., Aurele M., Liberty St. & Fairmount Ave., Trenton, N. J.
Moser Jewel Co., Perth Amboy, N. J.
Mildrum Jewel Co., East Berlin, Conn.
Sapphire Products Co., 51 Chambers, New York, N. Y.
Wennstrom's Sons Co., John, Suffern, N. Y.
Worley Jewel Co., John, Waltham, Mass.
Universal. See Oefinger, J. L.

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Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.
Macallen Co., Boston 27, Mass.
Sandow Tool Co., 1440 Broadway, New York, N. Y.
Sprecher Mfg. Co., P. W., 3230 North Ave., Milwaukee.
White Co., O. C., 15 Hermon, Worcester, Mass.
Wittenberg Bros., 60 Shipman, Newark, N. J.

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Ovens. See Ovens, Industrial & Laboratory.
Rheostats. See Rheostats.
Testing. See Testing.

LABORATORY STANDARD INSTRUMENTS. See Instruments, Laboratory Standard.
LACQUER, ARMATURE. See Paint, Varnish and Lacquer.
Metal. See Paint, Varnish and Lacquer.
LAMINATIONS. See Discs, Armature.
LAMP BASES. See Bases, Reading Lamp.
LAMP BULBS (Unfinished). See Bulbs, Glass.
LAMP FILAMENTS. See Filaments, Incandescent Lamp.
LAMP LEAD-IN WELDS. See Filaments, Incandescent Lamp.
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Allen Electric & Equipment Co., Kalamazoo, Michigan.
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Hobart Bros. Company, Troy, Ohio. (Test Bench).
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

LAVA. See Cores, Resistance Coil.
LEAD-IN WELDS, Lamp. See Filaments, Incandescent Lamp.
LEADS, FLEXIBLE (Commutator Brush). See Brushes, Commutator.

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Corning Glass Wks, Corning, N. Y. (Flashlight and Signal.)
Deknatel & Sons, J. A., Queens Village, N. Y.
Gilligan Glass Products Co., New Philadelphia, Ohio.
Goerz American Optical Co., C. P., 317 E. 34th, New York.
Jefferson Glass Co., Follansbee, W. Va. (Sign and Flashlight.)
Kliegl Bros. Universal Stage Ltg. Co., 321 W. 50th, New York, N. Y. (Condensing and Projector.)
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa. (Flashlight.)
North Lights Co., 30 W. 15th, New York, N. Y.
Popper & Sons, Leo, 147 Franklin, New York, N. Y.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.
Rochester Glass Products Co., 29 N. Water, Rochester, N. Y.
Rodefer Glass Co., Bellaire, O. (Flashlight.)
Sneath Glass Co., Hartford City, Ind. (Sign.)
Stromberg-Carlson Telephone Mfg. Co., 1050 University Ave., Rochester, N. Y.

LETTERS, Sign

Glass. Metal.

Adsign Corp, 113 W. 63rd, New York, N. Y.
Chain Products Co., 3924 Cooper Ave., Cleveland, O. (Brass and White Metal.)
Chicago Miniature Lamp Co., 652 W. Lake, Chicago, Ill. (Raised Letters for Signs.)
Eradium. See Pioneer Corporation.
Federal Elec. Co., 8700 S. State, Chicago, Ill. (Metal.)
Grammes & Sons, Inc., L. F., Allentown, Pa.
Heralite. See Pressed Prism Plate Glass Co.
Kolux Glass Sales Co., Kokomo, Ind.
Lu-Mi-Nus Signs, Inc., 2736 Wentworth Ave., Chicago, Ill.
Manhattan Elecl. Supply Co., 17 Park Place, New York, N. Y. (For Gas Signs.)
Opalite Corp., 201 E. Ohio, Chicago, Ill.
Pioneer Corporation, 8308 Yale Ave., Chicago. (Luminous.)
Pressed Prism Plate Glass Co., Chicago, Ill. (Glass.)

LIFTS, Armature

Lifts, Hoists, Jacks, Trucks, Buggies, Floor Cranes.

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Duff Mfg. Co., Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.

LININGS, Socket

Remington Mfg. Co., 937 Barnum Ave., Bridgeport, Conn.

LOCK WASHERS. See Washers, Lock.
LOOP WINDERS & SPREADERS. See Winding Machines, Armature & Field Coil.
LOUD SPEAKER DIAPHRAGMS MATERIAL. See Cloth, Untreated; also Parchment Paper.

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A. R. C. See American Reproducer Corp.
Amplion. See Woolf, J. W. & W. L.
Balsa Wood Reproducer Corp., 331 Madison Ave., New York.
Borkman Radio Corp., 152 E. Seventh, S. Salt Lake City, Utah.
Brielle. See Penn Mfg. Co.
Brooklyn Metal Stamping Corp., 720 Atlantic Ave., Brooklyn, N. Y. (Electric Pick-up.)
Cannonball. See Cannon & Miller Co.
Cannon & Miller Co., Springwater, N. Y.
Chelten Electric Co., 4859 Stenton Ave., Philadelphia, Pa.
Conamic. See Operadio Mfg. Co.
Decatur Mfg. Co., 45 Harman St., Brooklyn, N. Y.
Dreher & Son, Chas., 157 Spring, New York, N. Y.
Dymac. See Electrical Products Mfg. Co.
Electrical Products Mfg. Co., Providence, R. I.
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill. (Units.)
Empire United Hat Block Co., 312 E. 32nd, New York.
Engineers Service Co., 25 Church, New York, N. Y. (Kit.)
Ensco. See Engineers Service Co.
Fenco Cone Co., 57 Murray, New York, N. Y. (Kit.)
Fergus Co., 235 Elizabeth Ave., Newark, N. J.
Globe Technolian Corp., Reading, Mass.
G. R. P. See Penn Mfg. Co.
Grutal Speaker Co., 609 E. Walnut, Des Moines, Iowa.
Jensen Radio Mfg. Co., 338 N. Kedzie Ave., Chicago, Ill.
Lata Balsa. See Balsa Wood Reproducer Corp.
Magnavox Co., 4250 Horton, Oakland, Cal. Also Units.
Markone Radio Mfg. Co., 303 Devoe, Brooklyn, N. Y. (Horn.)
Miles Mfg. Co., 191 Joralemon, Brooklyn, N. Y.
Minuet. See Thompson Radio Co.
Molded Wood Products, 219 W. Chicago Ave., Chicago, Ill.
Mozart-Radioceive. See Fergus Co.
Newcombe-Hawley, Inc., St. Charles, Ill.
Newton Elec'l Mfg. Co., Newton, Mass.
O'Neil Mfg. Corp., West New York, N. J.
Operadio Mfg. Co., St. Charles, Ill.
Peerless. See United Radio Corp.
Penn Mfg. Co., G. R., 231 Mercer, New York, N. Y.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Philco. See Philadelphia Storage Battery Co.
Platter Cabinet Co., North Vernon, Ind.
Powerola. See Temple Corp.
Puropower. See Platter Cabinet Co.
Quam Radio Corp., 9703 Cottage Grove Ave., Chicago, Ill.
Racon Elec. Co., 18 Washington Place, New York, N. Y. (Horn only.)
Radio Cabinet Co., 2118 Gale, Indianapolis, Ind.
Red Lion Cabinet Co., Red Lion, Pa.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Swoboda Co., Maritime Bldg., Seattle, Wash.
Temple Corp., 1925 S. Western Ave., Chicago, Ill.
Thompson Radio Co., 25 Church, New York, N. Y.
Ultratone Mfg. Co., 1046 W. Van Buren, Chicago, Ill.
United Radio Corp., 25 Leighton Ave., Rochester, N. Y.
Universal. High Power Telephone Co., Carleton Ave. and Eddy, Seattle, Wash.
Utah Radio Products Co., 1615 S. Michigan Ave., Chicago, Ill. (Also Piano Unit.)
Victor Radio Corp., 4321 N. Western Ave., Chicago, Ill.
Wonderphone. See Universal High-Power Telephone Co.
Woolf J. W. & W. L., 227 Fulton, New York, N. Y.
Zisch Engineering Corp., Newark, N. J.

LUGS, Copper

Anderson Mfg. Co., Albert & J. M., 289 A St., Boston, Mass.
Dante Elecl. Mfg. Co., Bantam, Conn.
French Mfg. Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

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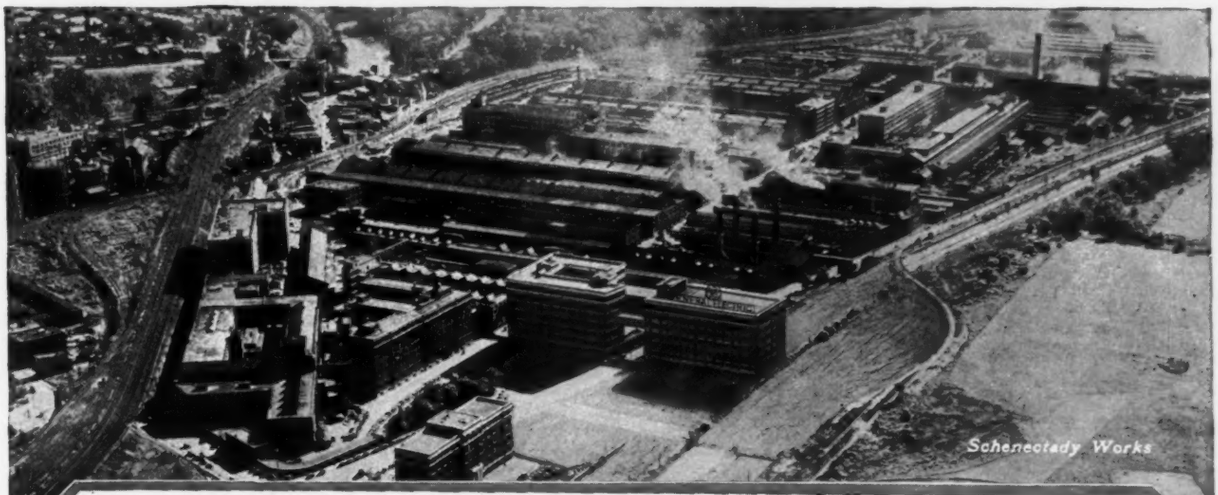

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Bryant Electric Co., Bridgeport, Conn. ..... P
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... R
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.
Eaglelite. See Eagle Elec. Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. ..... P
General Electric Co., Section W-232, Merchandise Dept., Bridgeport, Conn. ..... S P
Glow Lite. See Rodale Mfg. Co.
Glow Tip. See Arrow Electric Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Electric Co., Hartford, Conn. ..... S P
Hubbell, Inc., Harvey, Bridgeport, Conn. ..... P
Luma & Luma Lite. See Radium Dial Co.
Radieye. See General Electric Co.
Radium Dial Co., 3532 Forbes, Pittsburgh, Pa. .... C P
Reynolds Spring Co., Jackson, Mich. ..... S
Rodale Mfg. Co., 200 Hudson, New York, N. Y. ..... P
Seelite. See T. C. Smith & Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia .. P
Spot O Life. See Hart & Hegeman Mfg. Co.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y. ..... C S P

MACHINE SCREWS. See Screws, Machine.

MACHINE SCREW PRODUCTS. See Screw Machine Products.

MACHINES

Armature Banding. See Banding Machines, Armature
Armature Notching. See Notching Machines, Armature
Balancing. See Balancers, Armature.
Banding. See Banding Machines, Armature.
Cable Armoring. See Wire Manufacturing Machines.
Coil Shaping. See Shaping Machines, Coil.
Coil Taping. See Taping Machines, Coil.
Coil Winding. See Winding Machines.
Commutator Slotting. See Mica Undercutters.
Engraving. See Engraving Machines.
Incandescent Lamp Making. See Machines, Lamp Making
Molded Insulation. See Presses, Molded Insulation.
Perforating. See Perforating Machines.
Porcelain Molding. See Presses, Porcelain Molding.
Radio Tube. See Machines, Lamp Making.
Shaping. See Shaping Machines, Coil.
Slotting. See Mica Undercutters.
Soldering. See Soldering Machines, Commutator.
Spring Making. See Spring Making Machines.
Taping. See Taping Machines, Coil.
Tension. See Tension Machines, Band Wire.
Winding. See Winding Machines.
Wire, Armoring. See Wire Manufacturing Machines.
Wire Drawing. See Wire Drawing Machinery.
Wire Insulator. See Wire Manufacturing Machines.
Wire Measuring. See Wire Manufacturing Machines.
Wire Tension. See Tension Machines, Band Wire.
Wire Wrapping. See Wire Wrapping Machines.

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Dwyer Machine Co., Lynn, Mass.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Engineering & Supply Co., 160 5th Ave., New York, N. Y. Filament Winder.
Gesco. See General Engineering & Supply Co.
Sleeper & Hartley, Inc., Worcester, Mass.
York Elec. & Machine Co., 30 Penn, York, Pa.

MACHINES, Spring Making. See Spring Making Machines

MACHINES, WIRE MANUFACTURING. See Wire Manufacturing Machines.

MAGNET CHARGERS. See Chargers, Magnet.

MAGNET STEEL. See Steel, Magnet.

MAGNET TESTERS. See Instruments, Portable and Switchboard; also Instruments, Pocket.

MAGNET WIRE MACHINES. See Enameling Machines for Magnet Wire.

MAGNETIC CHUCKS. See Chucks, Magnetic.

MAGNETIC CLUTCHES. See Clutches, Magnetic.

MAGNETOMETERS. See Instruments, Pocket.

MAGNETS, Permanent

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Ind. Steel Products Co., 4545 S. Western Blvd., Chica.
Rogers Drop Forging Co., Worcester, Mass.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
Stiebt & Co., H. H., 13 Park Row, New
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.

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Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
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Holbrook Raw Hide Mfg. Co., 748 N. Main, Providence, R. I.

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METAL FINISHING. See Plating & Finishing.

METAL MARKING OUTFITS. See Engraving Machines.

METALLIC SHADES. See Shades, Metallic.

METERS. See Instruments.

MICA SHADES. See Shades, Mica.

MICA TAPE. See Tape, Mica.

MICA UNDERCUTTERS. See Slotting Machines & Tools Commutator.

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Asco. See Schoonmaker Insulation Co.
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Chicago Mica Co., 345 Campbell, Valparaiso, Ind.
Colonial Mica Co., 136 Seventh, Jersey City, N. J.
Fillion, S. O., 68 Murray, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Gerdau Co., Otto, 14 Liapenard, New York, N. Y.
Hirsch Mica Co. 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
International Mica Co., 3660 Brandywine, Philadelphia, Pa
Kant Krack. See Huse Liberty Mica Co.
Keene Mica Co., Keene, N. H.
Macallen Co., Boston 27, Mass.
Micabond. See Chicago Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
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Micanite. See Mica Insulator Co.
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Minerals & Insulation Co., 54 Greene St., New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Miralite. See Mitchell-Rand Mfg. Co.
Munsell & Co., Eugene, 200 Varick, New York, N. Y.
Nemco. See New England Mica Co.
New England Mica Co., Waltham, Mass.
New England Minerals, Inc., 85 Devonshire, Boston, Mass.
New York Mica & Mfg. Co., Auburn, N. Y.
Peerless. See New England Mica Co.
Prestonite. See Robt. K. Preston Mica Co.
Preston Mica Co., Robt. K., 957 Monadnock Blk., Chicago. (Ground Mica.)
Red Streak. See Huse Liberty Mica Co.
Rogers-Pyatt Shellac Co., 81 Water St., New York. (Imp.)
Schoonmaker Insulation Co., A. O., 34 University Place, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co. Plumtree, N. C.
Watson Bros., 170 Purchase, Boston, Mass.

MINIATURE SWITCHBOARD SYSTEMS. See Instruments, Portable and Switchboard.

MIXERS, INSULATION. See Insulation Mixers.

MOLDED

Presses. See Presses, Molded Insulation.
Radio Parts. See Radio Molded Parts.
Shades. See Molded Insulation.

MOLDED INSULATION

Alco. See American Insulator Corp.
Allen & Hills, Inc., Auburn, N. Y.
American Insulator Corp., New Freedom, Pa.
American Machine & Foundry Co., 5520 Second Ave., Brooklyn, N. Y.
Amerine. See American Insulator Corp.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Asbestos Shingle Slate & Sheathing Co., Ambler, Pa. (Cold.)
Auburn Button Wks., Auburn, N. Y.
Bakelite Corp., 247 Park Ave., New York, N. Y.
Bay State Moulding Co., 1197 Dorchester Ave., Boston.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldenmold. See Belden Mfg. Co.
Bell Mfg. Co., 11 Elkins, Boston, Mass. Radio Parts.
Boonton Molding Co., Boonton, N. J.
Boonton Rubber Mfg. Co., 223 Fanny Rd., Boonton, N. J.
Brelite Moulding Corp., 109 Hudson, Jersey City, N. J. (Wood Composition.)
Celoron Co., Bridgeport, Pa.
Cetelite. See Connecticut Molded Products Corp.
Cetec. See Connecticut Molded Products Corp.
Cepco. See Connecticut Molded Products Corp.
Coltrock. See Colt's Patent Firearms Mfg. Co.
Charmond Elec. Corp., 30 Church, New York, N. Y.
Chicago Molded Products Co., 2149 Walnut, Chicago, Ill.
Cincinnati Molding Co., 2037 Florence Ave., Cincinnati, O.
Colasta Co., Hoosick Falls, N. Y.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site, Inc., 207 Astor, Newark, N. J.
Condensite. See Bakelite Corp.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Molded Products Corp., Meriden, Conn. (Cold.)
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Dayton Insulating Molding Co., 434 E. First, Dayton, Ohio.
Dieumolding Production Co., Canastota, N. Y.
Dimco. See Dayton Insulating Moulding Co.
Durez. See General Plastics, Inc.
Electrose. See Insulation Mfg. Co.
Erinoid Co., Park Row Bldg., New York, N. Y.
Evercool. See Bakelite Corp.
Formica Insulation Co., 4628 Spring Grove Ave., Cincinnati, O.
Garfield Mfg. Co., Garfield, N. J. Composition. (Cold.)
General Electric Co., Schenectady, N. Y.
General Moulded Composition Co., 212 Market, Lynn, Mass.
General Plastics, Inc., 17 Walck Rd., N. Tonawanda, N. Y.
Gummor. See Garfield Mfg. Co.
Hahn Mfg. Co., Harry W., 623 S. San Pedro, Los Angeles, Cal.
Herculite See Colosta Co.
Huetter-Premier Machine Co., 7215 Livernois Ave., Detroit, Mich.
Hi-Heat. See Insulation Mfg. Co.

Imperial Molded Products Co., 2925 W. Harrison, Chicago.
Improco. See Insulation Products Co.
Inda. See American Machine & Foundry Co.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Insulation Products Co., 404 Richland, Pittsburgh, Pa.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
International Insulating Corp., Wyria, O.
Johnson Molding & Tool Co., Weymouth, Mass.
Karolith Corp., 189 13th, Long Island City, N. Y. (Casein plastics.)
Kellite. See Kellogg Switchboard & Supply Co.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Keystone Specialty Co., 2373½ Coventry Rd. (Lakewood), Cleveland, O.
Klagges, Chas., 128 147th, Ozone Park, N. Y.
Kuhn & Jacob Machine & Tool Co., 502 Prospect Ave., Trenton, N. J.
Kurz-Kasch Co., Dayton, O.
Lacanite. See Scranton Button Co.
Macallen Co., Boston, 27, Mass.
Mack Molding Co., Little Falls, N. J.
Makalot. See Johnson Molding & Tool Co.
Manchester Mfg. Co., Manchester Depot, Vt.
Megohom. See Waterbury Button Co.
Micarta Fabricators, Inc., 309 Canal, New York, N. Y.
Micarta. See Westinghouse Elec. & Mfg. Co.
Modern Molded Products Co., Blount and Elm Sts., Providence, R. I.
New England Products Co., 232 Greenwich, New York, N. Y.
Niagara Insul-Bake Specialty Co., 483 Delaware Ave., Albany, N. Y.
Nixon Nitration Works, Nixon, N. J.
Nixonoid. See Nixon Nitration Works.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Norloc. See Norton Laboratories, Inc.
Northern Industrial Chemical Co., 11 Elkin, South Boston.
Norton Laboratories, Inc., 1025 Mill, Lockport, N. Y.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Paramix. See Splitdorf Radio Corp.
Paratherm. See Scranton Button Co.
Phenolic. See Scranton Button Co.
Pruven Composition Products Corp., Milford, Conn.
Pruvenite. See Pruven Composition Products Co.
Pyrolax. See Cutler-Hammer Mfg. Co.
Recto Mfg. Co., 23 W. 3rd, Cincinnati, O.
Redmonol. See Bakelite Corp.
Rexlite. See Northern Industrial Chemical Co.
Reynolds Spring Co., Jackson, Mich.
Reynoldite. See Reynolds Spring Co.
Reynomold. See Reynolds Spring Co.
Richardson Co., Lockland, Cincinnati, O.
Ridgelite. See Ridgley Trimmer Co.
Ridgley Trimmer Co., Springfield, O.
Schneider Bros., Inc., 304 N. Sheldon Ave., Chicago.
Scranton Button Co., Scranton, Pa.
Shaw Insulator Co., Irvington, Newark, N. J.
Siemon Co., State and Dewey, Bridgeport, Conn.
Specialty Insulation Mfg. Co., Hoosick Falls, N. Y.
Star Insulate. See Insulation Mfg. Co.
Starite. See Insulation Mfg. Co.
Stokes & Smith Co., Summerdale Ave. near Roosevelt Blvd., Philadelphia, Pa.
Synthane Corp., Oaks, Pa.
Textolite. See General Elec. Co.
Thermoplax. See Cutler-Hammer Mfg. Co.
Tegit. See Garfield Mfg. Co.
Union Insulating Co., Parkersburg, W. Va.
Vulcabeston. See Colt's Patent Fire Arms Mfg. Co.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.
Waterbury Button Co., Waterbury, Conn.
Watertown Mfg. Co., Watertown, Conn.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

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Elkon, Inc. (Div. of P. R. Mallory Co.), 350 Madison Ave., New York, N. Y.
Lohfeld & Co., J. L., 53 Park Place., New York, N. Y.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.
Radiotherma, Inc., 45 E. 17th, New York, N. Y.
Sirian Wire Co., 255 Sherman Ave., Newark, N. J.

MONEL METAL

International Nickel Co., 67 Wall, New York, N. Y.

MOTOR CONTROLLERS. See Controllers, Motor.

MOTOR PLATFORM BASES. See Bases, Motor Platform

MOTOR STARTERS. See Controllers, Motor; Switches, Remote Control; Switches, Motor Starting; Safety; Switches Snap (Heavy Duty).

MOTORS

Alternating Current ..... See S
Direct Current ..... See S
Motors, 1 Hp. up ..... See M
Motors Fractional Hp. ..... See F
Universal ..... See U

Actodector. See Roth Bros. & Co.
Advance Elec. Co., 4311 Maple Ave., St. Louis M F S ..
Allis-Chalmers Mfg. Co., Milwaukee, Wis. ..... M .. S ..
Allis Co., Louis, Milwaukee, Wis. ..... M .. S ..
American Elec. Motor Co., Cedarburg, Wis. ..... M .. .. ..

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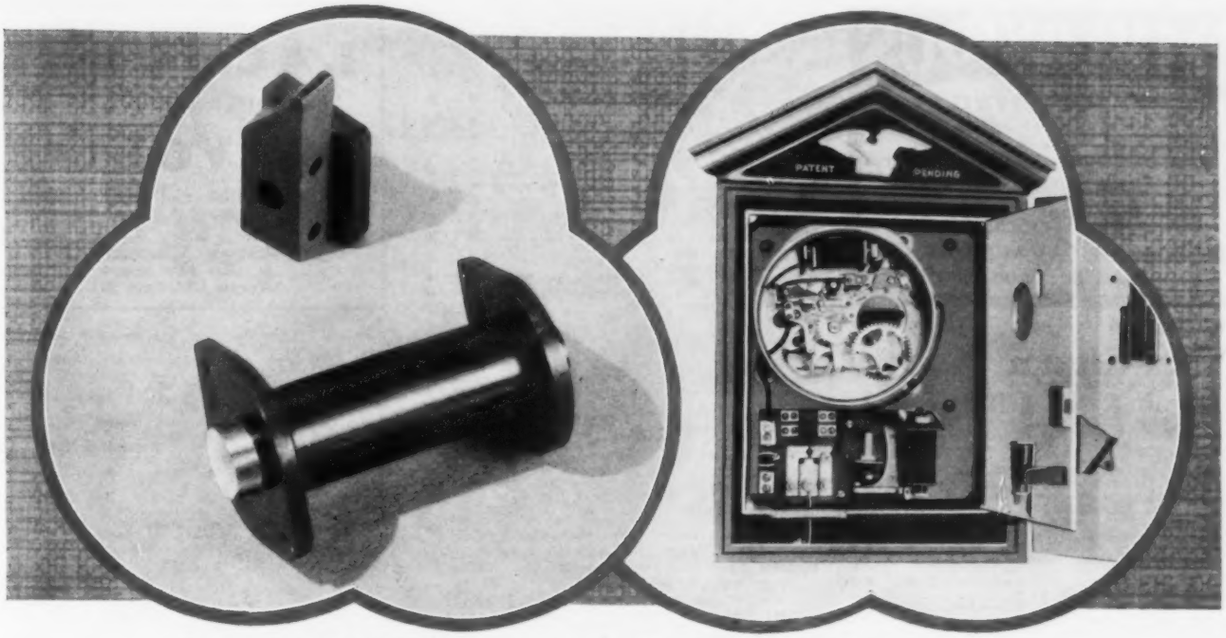

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Armor Elec. Mfg. Co., 1030 Holland, Erie, Pa. M . . . .
Baldor Elec. Co., 4352 Duncan Ave., St. Louis M F S ..
B-Line. See Brown-Breckmeyer Co.
Bodine Elec. Co., 2254 Ohio, Chicago.... .. F S U
Bogue Elec. Co., Chas. J., 132 King, New York M . . . .
Brown-Brockmeyer Co., Norwood Power Bldg., Dayton, O.... M F . .
Burke Elec. Co., Erie, Pa.... M F S U
B. T. See Allis Ch., Louis.
B & R Mfg. Co., 813 Lafayette, Toledo, O.... .. F . . .
Century Elec. Co., 1806 Pine, St. Louis, Mo.. M F S ..
Chandeysson Elec. Co., St. Louis, Mo.... M . . S ..
Clark, Jr., Elec. Co., James, 600 E. Bergman, Louisville, Ky. .... M . . . .
Cleveland Armature Wks., 4732 St. Clair Ave., Cleveland, O. .... M . . S ..
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J. M . . S U
Cushman Elec. Co., Concord, N. H.... M F S ..
Day-Fan Electric Co., Dept. A, Dayton, O.... .. F S ..
Diehl Mfg. Co., Elizabeth, N. J.... M F S ..
Diverter Pole. See Rochester Elec. Product Co.
Domestic Electric Co., 7209 St. Clair Ave., Cleveland, O. .... S U
Dumore. See Wisconsin Elec. Co.
Eclipse. See Fidelity Elec. Co.
Electric Machinery Co., Minneapolis, Minn.. M . . S ..
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. ....
Electric Specialty Co., 221 South Stamford, Conn. M F S U
Electro-Dynamic Co., Bayonne, N. J.... M . . S ..
Emerson Electric Mfg. Co., 2014 Washington Ave., St. Louis, Mo.... M F S U
Engberg's Elec. & Mechl. Works, St. Joseph, Mich. .... M . . S ..
Esco. See Electric Specialty Co.
Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill. .... M F . . .
Fidelity Elec. Co., Lancaster, Pa.... M F S U
Fitzgerald Mfg. Co., Torrington, Conn.... .. F . . .
Fynn Weichsel. See Wagner Elec. Corp.
Galvin Elec. Mfg. Co., 3314 S. Broadway, St. Louis, Mo. .... .. F . . S ..
General Elec. Co., Schenectady, N. Y.... M F S U
Gilbert Co., A. C., New Haven, Conn.... .. F S U
Hamilton Beach Mfg. Co., Racine, Wis.... .. F S U
Hobart Bros. Co., Troy, O.... .. .. M . . S ..
Holtzer-Cabot Elec. Co., 125 Amory, Boston... M F S ..
Howell Elec. Motors Co., Howell, Mich.... M . . S ..
Ideal Elec. & Mfg. Co., Mansfield, O.... M . . S ..
Imperial Electric Co., Akron, O.... M . . S ..
Janette Mfg. Co., 556 W. Monroe, Chicago.... .. F S ..
Jantz & Leist Elec. Co., Cincinnati, O.... M F . . .
Jeanin Electric Co., Toledo, O.... M F S ..
Kendrick & Davis Co., Lebanon, N. H.... .. F S ..
Kimble Elec. Co., 634 N. Western Ave., Chicago M . . S U
Knapp Elec., Inc. (Div. of P. R. Mallory & Co.), Port Chester, N. Y.... .. F S U
Leland Elec. Co., Dayton, O.... .. F S ..
L. E. See Leland Elec. Co.
Lincoln Elec. Co., Cleveland, Ohio.... M . . S ..
Line-Weld. See Lincoln Elec. Co.
Linzee Elec. Motor Co., Mansfield, O.... M . . . .
Mando Co., Syracuse, N. Y.... .. F . . . .
Marathon Elec. Mfg. Co., 32 Island, Wausau, Wis. .. F . . . .
Marble-Card Elec. Co., Gladstone, Mich.... M . . . .
Master Electric Co., Dayton, O.... M F S ..
MC. See General Electric Co.
Michigan Elec. & Mfg. Co., Lake Linden, Mich. .. F S ..
N. C. See Electric Controller & Mfg. Co.
Norfolk. See Walter Elec. Mfg. Co.
North East Elec. Co., Rochester, N. Y.... .. F . . U
Northwestern Mfg. Co., 480 Clinton, Milwaukee M . . . .
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio .... .. F S ..
O. K. See Marathon Elec. Mfg. Co.
Osann Co., F., 245 Seventh Ave., New York M . . . .
Peerless Elec. Co., 740 W. Market St., Warren, O. M F S U
Polar Cub. See Gilbert Co., A. C.
Pow-R-Full. See Wagner Elec. Corp.
Reco. See Reynolds Electric Co.
Red Band. See Howell Elec. Motors Co.
Reliance Elec. & Engrg. Co., 1042 Ivanhoe Rd., Cleveland, O. .... M . . S ..
Reynolds Electric Co., 2850 W. Congress, Chicago .. F S ..
Robbins & Myers, Inc., Springfield, O.... M F S U
Roth Bros. & Co., Chicago, Ill.... M . . S ..
Standard. See Robbins & Myers Co.
Star Elec. Motor Co., Miller St. & N. J. R. R. Ave., Newark, N. J.... M . . S ..
Sterling Elec. Motors, Inc., Telegraph Rd. and Atlantic Blvd., Los Angeles, Cal.... M . . S ..
Stow Mfg. Co., Binghamton, N. Y.... M F S U
Sturtevant Co., 15 Devonshire (Hyde Park), Boston, Mass. .... M F S U
Sunlight Electrical Mfg. Co., Warren, O.... .. F S ..
Super Wick. See Master Elec. Co.

Switch start. See Lincoln Elec. Co.
Triumph Elec. Corp., Carthage, O.... M . . S . .
Union Elec. Motor Mfg. Co., Hancock & Oxford Sts., Philadelphia, Pa.... M F S . .
U. S. Elec. Mfg. Co., 200 E. Slawson Ave., Los Angeles .... M . . S . .
Valley Elec. Co., 4221 Forest Park Blvd., St. Louis, Mo. .... M . . S . .
Wagner Elec. Corp., 6400 Plymouth Ave., St. Louis, Mo. .... M F S U
Walter Elec. Mfg. Co., Norfolk, Va.... M . . S . .
Watson. See Allis Co., Louis.
Welco Uniframe. See Wesche Elec. Co., B. A.
Wesche Elec. Co., B. A., 1622 Vine, Cincinnati M F S . .
Westinghouse Elec. Mfg. Co., East Pittsburgh M F S . .
Willey-Wray Elec. Co., Cincinnati, O.... M . . S . .
Wisconsin Elec. Co., 35 16th, Racine, Wis.... .. F . . U
Woods Mach. Co., S. A., Boston.... M F S . .
Zobell Elec. Motor Co., Garwood, N. J.... M . . S . .

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Grammes & Sons Inc., L. F., Allentown, Pa.
Premier Metal Etching Co., 14th & Van Alst Ave., Long Island City, N. J.
Waterbury Button Co., Waterbury, Conn.

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Driver-Harris Co., Harrison, N. J.
International Nickel Co., 67 Wall, New York, N. Y.
Seymour Mfg. Co., Seymour, Conn.
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NUT SETTING MACHINES

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OIL-LESS BEARINGS. See Bearings, Oil-less.

OSCILLOSCOPES. See Instruments, Laboratory Standard.

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Crawford Oven Co., New Haven, Conn. (Coil Driers.)
Despatch Oven Co., 120 First Ave., N. Minneapolis, Minn.
Detroit Sheet Metal Wks., 1341 E. Milwaukee Ave., Detroit, Mich.
Devine Mfg. Co., J. P., Buffalo, N. Y.
Eberbach & Son Co., Ann Arbor, Mich. (Drying.)
Electric Heat Control Apparatus Co., 245 New Jersey R. R. Ave., Newark, N. J.
Emerson Apparatus Co., Melrose, Mass. (Conditioning.)
Freas Thermo Elec. Co., 1206 Grove, Irvington, N. J.
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General Electric Co., Schenectady, N. Y.
Hayes, C. I., 129 Baker, Providence, R. I.
Heidbrink Co., 2633 Fourth Ave., S., Minneapolis, Minn.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Kenworthy, Chas. F., 198 Piedmont, Waterbury, Conn.
Maehler Co., Paul, 2210 Lake, Chicago, Ill.
Miho Co., 717 Sycamore, Cincinnati, O.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Sargent & Co. E. H., 155 E. Superior, Chicago, Ill.
Sioux Battery & Mfg. Co., Sioux City, Ia. (Battery.)
Snead & Co., Jersey City, N. J.
Standard Elec. Stove Co., Toledo, Ohio.
Steiner & Co., H. E., 197 E. Kinney St., Newark, N. J.
Stokes Machine Co., F. J., 5826 Tabor Rd., Philadelphia, Pa.
Swartwout Co., 18522 Euclid Ave., Cleveland, O.
Thelco. See Freas Thermo Elec. Co.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Young Bros. Co., 6500 Mack, Detroit, Mich.

OXIDES, Battery. See Chemicals, Battery.

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Cooke Seal Ring, Dept. K, 46 N. Green St., Chicago, Ill.
Federal Metallic Packing Co., Wakefield, Mass.
Packtite. See Federal Metallic Packing Co.

PAINT, Varnish, Lacquer

KEY
Varnishes, Insulating .....See V
Painting, Dipping, Spraying, Vacuum Impregnating.
Paint, Insulating and Acid Proof..See P
Lacquer, Metal Finishing .....See L

Acme White Lead & Color Wks., 8250 St. Aubin Ave., Detroit, Mich. L
Ajax. See Sherwin-Williams Co.
Alaka. See Lacquer & Chemical Corp.
American Di-Electrics, Ltd., Hancock and Bodine, Long Island City, N. Y. .... V . . .
American Lastite Co., 3166 Lincoln Ave., Chicago... . . P L
Antakwa Co., 1329 Mohawk, Chicago, Ill.... .. . . P .
Arizona Lacquer Mfg. Co., 7 16th, Brooklyn, N. Y. L
Armlac. See Robertson Chemical Co.
Armlac. See Arizona Lacquer Mfg. Co.
Art-Craft. See Southwestern Paint & Varnish Co.
Atlantic Chemical Co., Coit, Irvington, N. J.... . . . L
Atom Chemical Co., 96 E. 10th, New York, N. Y. L
Bakelite Corp., 247 Park Ave., New York, N. Y.... . . L
Benolite Varnish Co., Pittsburgh.... V P . .
Berry Bros., Leib & Wight, Detroit, Mich.... V . . . .
Billings-Chapin Co., 1163 E. 40th, Cleveland, O.. V . . .
Biwax Corp., 208 S. La Salle, Chicago, Ill.... .. P . .
Bradley-Huritz Co., 2626 S. Dearborn, Chicago, Ill. L
Brevolite. See Waukegan Chemical Co.
Calman & Co., Emil, 42 Vernon Blvd., Long Island City, N. Y. .... V P . .

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Chinalac. See Dolph Co., John C.
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. .... V P . .
Code 25. See Mitchell-Rand Mfg. Co.
Columbus Varnish Co., 264 Cozzens, Columbus, O. V . . . .
Comulac. See Martindale Elec. Co.
Dolph Co., John C., 168 Emmet, Newark, N. J.. V P . .
Duco. See Du Pont de Nemours & Co.
Du Pont de Nemours & Co., Wilmington, Del... . P . .
Eastman Kodak Co., Rochester, N. Y.... . . . L
Eclipse Paint & Mfg. Co., Cleveland, O.... . P . .
E. B. See Mitchell-Rand Mfg. Co.
Egyptian Lacquer Mfg. Co., 90 West, New York.. . . . L
Electric Lacquer. See Dolph Co., John C.
Enamelac. See Robertson Chemical Co.
Ever-Brite Products Co., East Liverpool, O.... . . . L
Franche & Co., 440 Orleans, Chicago, Ill.... . . . L
General Elec. Co., Section W-232, Merchandise Dept., Bridgeport, Conn. .... V P . .
General Plastics, Inc., 17 Walck Rd., N. Tonawanda, N. Y. .... V . . . .
George Co., P. D., St. Louis, Mo.... V . . . .
G. E. See General Elec. Co.
Glidden Co., Cleveland, O.... V P L
H. B. See Maas & Waldstein Co.
Hilo Varnish Corp., Marcy & Flushing Aves., Brooklyn, N. Y. .... V P L
Impervious Varnish Corp., 421 Wood, Pittsburgh, V P . .
Insulaterite. See Ohmlac Paint & Refining Co.
Insulvar. See Varflex Corp.
Irvington Varnish & Insulator Co., Irvington, N. J. V P L
Kodalak. See Eastman Kodak Co.
Krakles. See Waukegan Chemical Co.
Lacquer & Chemical Corp., 214-40th St., Brooklyn, N. Y. .... .. P L
Laquerold. See Glidden Co.
Liberty. See Antakwa Co.
Linolac. See Mica Insulator Co.
Lowe Bros. Co., 450 E. 3rd, Dayton, O.... V P . .
Lucas & Co., John, 322 Race, Philadelphia, Pa.. V P . .
Lucote. See Lucas & Co., John.
Maas & Waldstein, 438 Riverside Ave., Newark, N. J. L
McDougall-Butler Co., Inc., Evans Water & Norton, Buffalo, N. Y. .... V P . .
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O. .... V . . . .
Mawalac. See Maas & Waldstein.
Mecco. See Henry V. Walker Co.
Mica Insulator Co., 200 Varick St., New York.... V . . . .
M. I. C. See Mica Insulator Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. V P . .
Nepto Lac. See Lowe Bros. Co.
Nikolas & Co., G. J., 1227 W. Van Buren, Chicago. . . . L
O'Brien Varnish Co., South Bend, Ind.... V P L
Ohmlac Refining Co., 140 S. Dearborn, Chicago, Ill. .. P . .
Opex. See Sherwin-Williams Co.
Ozite. See Standard Underground Cable Co.
P. & B. See Ruberoid Co.
Pacoria Paint Co., 4th & Sedgeley Ave., Philadelphia, Pa. L
Pedigree. See George Co., P. D.
Peninsular Paint & Varnish Co., Detroit, Mich. L
Peerless. See Maas & Waldstein Co.
Prolin. See Acme White Lead & Color Wks.
Pruett-Schaeffer Chemical Co., Taber, Pittsburgh. . . P L
Reliable Leather Dressing Co., 43 Crescent, Long Island City, N. Y. .... V . . . .
Republic Varnish Co., 200 Thomas, Newark, N. J. V . . . .
Robertson Chemical Co., 9805 Meech Ave., Cleveland, O. .... V P . .
Rockbestine. See Rockbestos Products Corp.
Rockbestos Products Corp., New Haven, Conn..... V . . . .
S. P. C. See Ruberoid Co.
Schenectady Varnish Co., Schenectady, N. Y..... V P . .
Sherwin-Williams Co., Cleveland, O.... V P L
Sipe & Co., James B., Chamber of Commerce Bldg., Pittsburgh, Pa. L
Southwestern Paint & Varnish Co., 610 Broadway, Kansas City, Mo .... V P . .
Standard Flexible Comp. Co., Franklin Trust Bldg., Philadelphia, Pa. .... V P . .
Standard Insulation Co., Rutherford, N. J..... V . . . .
Standard Lacquer Co., 621 Broadway, New York, N. Y. L
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa. .... .. P . .
Standard Varnish Wks., 443 4th Ave., New York. V P L
Sterling Varnish Co., Haysville, Pa.... V . . . .
Toch Bros., 443 4th Ave., New York.... V P L
Truscon Laboratories, Canift & Grand Trunk Railway, Detroit, Mich.... V . . . .
2098. See Mitchell-Rand Mfg. Co.
Varflex Corp., Rome, N. Y.... V . . . .
Voltaz Co., 99 Reservoir Ave., Bridgeport, Conn. V P . .
Vulcan-Lastite. See American Lastite Co.
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Waipole. See Robertson Chemical Co.

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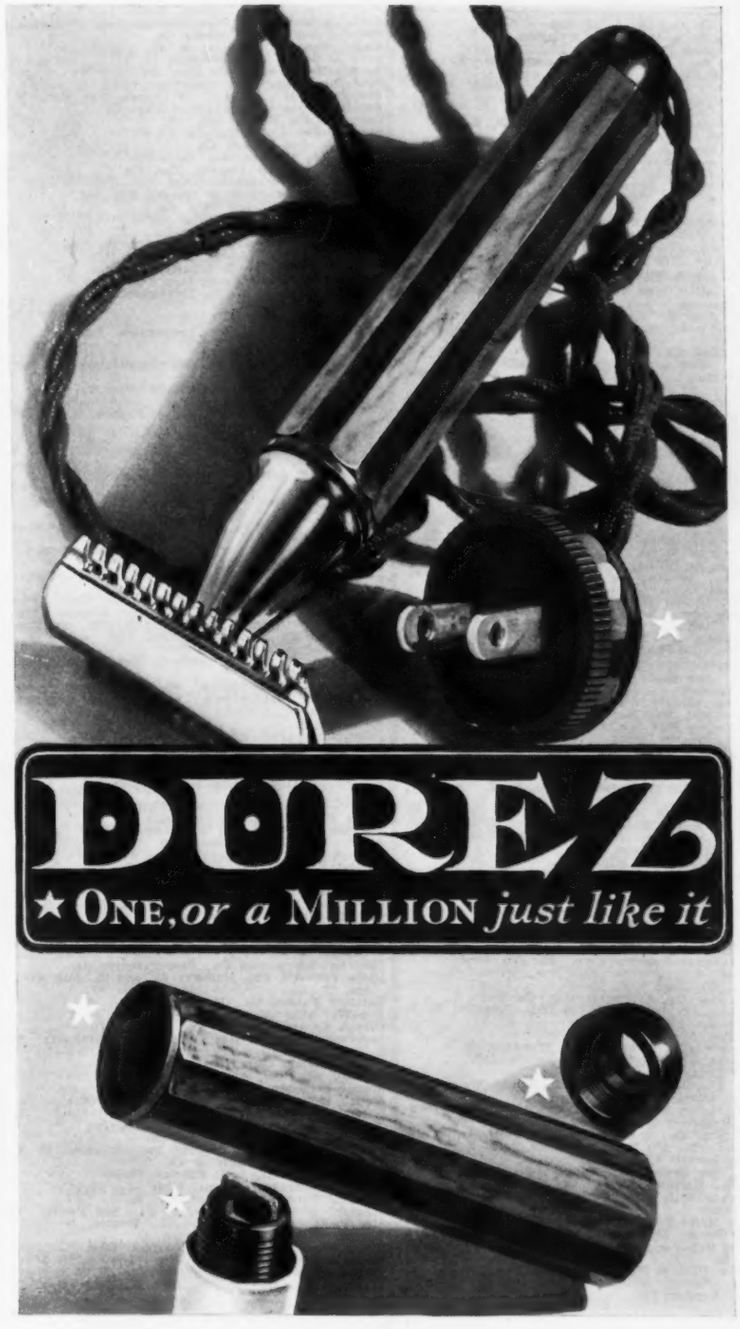

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Waukegan Chemical Co., North Chicago, Ill..... L
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa. V P L
Zapon Co., Stamford, Conn..... L
Zeliac. See Zeller Lacquer Mfg. Co.
Zeller Lacquer Mfg. Co., 20 E. 49th, New York..... L

PANELS (panel) Engraving. See Engraving.
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Radio (Hard Rubber) See Rubber Hard.
Meters. See Instruments, Portable & Switchboard.

PAPER
Boxes. See Boxes & Wrappers.
Bushings. See Tubes, Paper.
Candles. See Candles, Fixture.
Cores. See Tubes, Paper.
Fibre. See Cloth and Paper.
Fish. See Cloth & Paper.
Insulating. See Cloth and Paper.
Parchment. See Parchment Paper.
Shades. See Shades, Fabric.
Sleeves. See Tubes, Paper.

PARAFFINE. See Wax and Compounds.

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White Supply Co., 4347 Duncan, St. Louis, Mo.

PENS, Scorching
Gilbert Supply Co., Independence, Iowa.
Little Speedster. See Gilbert Supply Co.
Post Elec. Co., 7 E. 44th, New York, N. Y.
Stylectric. See Post Electric Co.

PERFORATING MACHINES
American Perforator Co., 617 W. Jackson, Chicago, Ill.
Asam Bros., 917 Arch, Philadelphia, Pa.
Asam Wright. See Asam Bros.
Capital Novelty Co., Lincoln, Neb.
Cummings Co., B. P., 4740 Ravenswood Park, Chicago, Ill.
Hamilton Engrs. Products Co., Hamilton, Ohio (Mueis Rolls).

PHENOLIC INSULATION. See Fibre, Phenol. Also Molded Insulation.

PHOSPHOR BRONZE
(Ingot, Rod, Sheet, Wire)
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Elephant Brand. See Phosphor-Bronze Smelting Co.
Gilby Wire Co., Riverside Ave., Newark, N. J.
Phosphor-Bronze Smelting Co., 2200 Washington Ave., Philadelphia, Pa.
Scovil Mfg. Co., Waterbury, Conn.

PHOTO-ELECTRIC TUBES
Burt, R. C., 327 S. Michigan Ave., Pasadena, Cal.
Foto Cell. See Raytheon Mfg. Co.
General Electric Co., Schenectady, N. Y.
Kino-Lamp. See Raytheon Mfg. Co.
Photion Instrument Corp., 574 Southern Blvd., New York.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Raytheon Mfg. Co., Cambridge, Mass.
Westinghouse Elec. & Mfg. Co., Mansfield, Ohio.

PHOTOMETERS, Lamp Testing
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Foote, Pierson & Co., 160 Duane, New York, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa
Holophane Co., 342 Madison Ave., New York, N. Y.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Luxometer. See James G. Biddle.
Mathews. See Foote, Pierson & Co.
National Lamp Wks of G. E. Co., Cleveland, O.

PICK-UPS, TALKING MACHINE. See Loud Speakers.

PIGTAILS, Commutator. See Brushes, Commutator.
Wire Gauze. See Brushes, Commutator.
Vacuum Cleaner. See Brushes for Vacuum Cleaners.

PINIONS. See Gears and Pinions.

PINION PULLERS. See Pullers, Armature Shaft.

PLASTICS. See Molded Insulation.

PLATES, Name. See Name Plates; Also Decalcomania.

PLATES
Fixture Outlet. See Fixture Fittings.
Storage Battery. See Plates, Storage Battery.

PLATES, Storage Battery
Am-Plus Storage Battery Co., 425 W. Superior, Chicago.
Are Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Champion. See Englert Mfg. Co.
C. & B. Battery Co., 1535 S. State, Chicago, Ill.
Edes Mfg. Co., Plymouth, Mass.
Englert Mfg. Co., 2500 Jane, Pittsburgh, Pa.
Esto. See New Jersey Storage Battery Co.
Fort Wayne Battery Mfg. Co., 230 E. Fourth, Ft. Wayne.
Handler. See Witherbee Storage Battery Co.
Link & Hemelick, Inc., 555 W. 52nd St., New York, N. Y.
New Jersey Storage Battery Co., 654 Summit Ave., Union City, N. J.
Universal Battery Co., 3410 S. La Salle, Chicago, Ill.
Witherbee Storage Battery Co., 75 Columbus Ave., New York.

PLATING GENERATORS
American Giant. See Connecticut Dynamo Motor Co.
Bogue Elec. Co., Chas. J., 132 King, New York, N. Y.
Burke Elec. Co., Erie, Pa.

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Connecticut Dynamoz Motor Co., Irvington, N. J.
Compro. See Eager Elec. Co.
Eager Electric Co., 523 Nevell, Watertown, N. Y.
Eclipse. See Fidelity Elec. Co.
Electric Specialty Co., 229 South, Stamford, Conn.
Esco. See Electric Speciality Co.
Fidelity Elec. Co., Lancaster, Pa.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Hobart Bros. Co., Troy, O.
Holtzer-Cabot Elec. Co., 125 Amory, Boston, Mass.
Ideal Electric & Mfg. Co., East Third St., Mansfield, O.
Jantz & Zeist Elec. Co., Cincinnati, O.
Kendrick & Davis Co., Lebanon, N. H.
L'Hommedieu & Sons Co., Chas. F., 4521 Ogden Ave., Chicago, Ill.
Optimus. See Hanson-Van Winkle & Munning Co.
Reliance. See L'Hommedieu & Sons Co., Chas. F.
Roth Bros. & Co., Chicago, Ill.
Westinghouse Elec. Mfg. Co., East Pittsburgh, Pa.

PLATING AND FINISHING
Chromium Plating, Rust Proofing and other special metal-finishing processes.
Amaloy. See American Machine & Foundry Co.
American Machine & Foundry Co., 5520 Second Ave., Brooklyn, N. Y.
Atlantic Chemical Co., Colt, Irvington, N. J.
Duro Chrome. See General Chromium Corp.
General Chromium Corp., 3220 Bellevue Ave., Detroit, Mich. (Chromium Plate.)
Parker Rust-Proof Co., 2177 E. Milwaukee, Detroit, Mich.
Rochester Elec. Products Corp., 89 Allen, Rochester, N. Y.
United Chromium, Inc., 30 E. 42nd, New York, N. Y.
Udylite Process Co., 3220 Bellevue Ave., Detroit, Mich. (Rust-Proof Finish.)

PLATINUM,
Sheet, Rod, Tubing, Wire.
American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Interstate Products Corp., 29 Commercial, Newark, N. J.
R. & H. Platinum Works, 709 Sixth Ave., New York.
Wilco. See H. A. Wilson Co.
Wildberg Bros., Smelting & Refining Co., 742 Market, San Francisco, Cal.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

PLUG FUSES. See Fuses and Fuse Wire.

PLUG RECEPTACLES. See Receptacles, Plug.

PLUGS, Flashing. See Flashers, Sign.

PLUGS, Radio. See Radio Receiver Parts.

PLUGS, Attachment
A-1 Bakelite. See Connecticut Elec. Mfg. Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alcor Mfg. Co., 4605 W. Madison, Chicago.
Anselite Elec. Mfg. Co., New Haven, Conn.
Anylite Elec. Co., Fort Wayne, Ind.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Arre-Grip. See Arrow Elec.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bee-Ell Elec. Mfg. Co., 79 Mercer, New York, N. Y.
Belden Mfg. Co., 2310 B. S. Western Ave., Chicago, Ill. (Special Soft Rubber Plug Furnished with Belden Cords).
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Elec. Co., Bridgeport.
C. H. See Cutler-Hammer Mfg. Co.
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn.
Cemco. See Connecticut Elec. Mfg. Co.
Cetelite. See Connecticut Moulded Products.
Circle F Mfg. Co., Trenton, N. J.
Colts Patent Fire Arms Mfg. Co., Hartford, Conn.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Moulded Products Corp., Meriden, Conn.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Diamond, H. See Hart Mfg. Co.
Dreadnaught. See Cutler-Hammer Mfg. Co.
Eagle Elec. Mfg. Co., Dept. ER4, 50 Hall, Brooklyn, N. Y.
Eastman Mfg. Co., Manitowoc, Wis.
Electric Co., 94 Allyn, Hartford, Conn.
Ericson Mfg. Co., 3237 Bradford Rd., Cleveland, O.
Esler Elec. Mfg. Co., 802 S. Adams, Marion, Ind.
Fitzall. See Redale Mfg. Co.
Gayner Elec. Co., Inc., Stratford Ave., Bridgeport, Conn.
GE-Flex. See General Electric Co.
General Electric Co., Section W-232, Bridgeport, Conn. (Special Soft Rubber Plug furnished with G. E. Cords.)
Globe Metal Mfg. Co., 2122 E. Hazzard, Philadelphia, Pa.
Gold Seal Elec. Co., 250 Park Ave., New York, N. Y.
Gripall. See Beaver Mfg. Co.
Handle Cap. See Beaver Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Heetach. See Marks Products Co.
Homco. See Bryant Electric Co.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
H. & H. See Hart & Hegeman.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Iona Co., Los Angeles, Cal.

Jiffy. See Esler Elec. Mfg. Co.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Marks Products Co., 23 E. 16th, New York.
Metropolitan Electric Mfg. Co., Blvd. at 14th St., Long Island City, N. Y.
Nelco. See Nelson Elec. Co.
Nelson Elec. Co., Plant City, Fla.
P. & S. See Pass & Seymour.
Paragon Elec. Sales Co., 215 S. Fifth, Philadelphia, Pa.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.
Propp Co., M., 534 Broadway, New York.
Quick Catch. See Hubbell, Inc., Harvey.
Real. See Smith & Co., T. C.
Real Diamond. See Smith & Co., T. C.
Reben Electric Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Reynolds Spring Co., Jackson, Mich.
Reynolite Masterpiece. See Reynolds Spring Co.
Ripple. See Bryant Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York.
Safegard Elec. Appliance Co., 1015 Chestnut, Philadelphia.
Samson Cutlery Co., 8 Jones, Rochester, N. Y.
Sears, Henry D., 80 Boylston, Boston 11, Mass.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Snapit. See Marks Products Co.
Snoco. See Snow & Co., E. W.
Snow & Co., E. W., Rochester, N. Y.
Spartanette. See Bryant Elec. Co.
Spar Tap. See Bryant Elec. Co.
Speedway Elec. Mfg. Co., 30 Church, New York, N. Y.
Standard. See Cutler-Hammer Mfg. Co.
Sultzall. See Beaver Mfg. Co.
Surefit. See Alcor Mfg. Co.
T. E. C. See Electric Co.
Tedco. See Paragon Elec. Sales Co.
Telltale Tap. See General Elec. Co.
Templus. See Bryant Elec. Co.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trio-Tap. See Rodale Mfg. Co.
Triple Tap. See General Elec. Co.
Twin Tap. See General Elec. Co.
United States Elec. Mfg. Co., 222 W. 14th, New York.
Un-X-Ld. See Speedway Elec'l Mfg. Co.
Utile Mfg. Co., 320 E. Liberty, Lancaster, Pa.
Weber. See Sears, Henry D.
Wellmade Elec. Mfg. Co., Torrington, Conn.
Wilshires. See Iona Co.
Yankee. See Beaver Mfg. Co.

POCKET METERS. See Instruments, Pocket.

POINTS, Contact
American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J. (Gold, Platinum, Silver.)
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J. (Platinum and Silver.)
Cohn, Sigmund, 44 Gold, New York, N. Y. (Platinum.)
Elkon, Inc. (Div. of P. R. Mallory Co.), 350 Madison Ave., New York, N. Y.
Fansteel Products Co., North Chicago, Ill.
Hardy Metal Corp., Seattle, Wash.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Independent Contact Mfg. Co., 545 39th, Union City, N. J. (Tungsten.)
Interstate Products Corp., 29 Commercial, Newark, N. J. (Platinum and Silver.)
King Mfg. Corp., Rano & Crowley Sts., Buffalo, N. Y. (Platinum.)
National Contact Co., 33 W. 60th, New York. (Platinum.)
Niehoff & Co., C. E., 230 W. Superior, Chicago. (Platinum.)
R. & H. Platinum Works, 709 Sixth Ave., New York.
Spark-O-Metal. See Hardy Metal Corp.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J. (Platinum and Silver.)

POLARITY INDICATORS. See Instruments, Pocket.

POLISHING MACHINES, WIRE. See Wire Polishing Machines.

PORCELAIN
Bushings. See Bushings, Box & Cabinet.
Liquid. See Cement, Liquid Porcelain.
Molding Machine. See Presses, Porcelain Molding.
Reflectors (Enameled). See Reflectors, Porcelain Enameled.
Refractory. See Cores, Resistance Coil.

PORCELAIN, Special Shapes
Akron Porcelain Co., Akron, Ohio.
American Porcelain Co., E. Liverpool, O.
A. P. See Akron Porcelain Co.
Burgess & Co., East Liverpool, O.
Central Porcelain Co., Columbiana, O.
Circle F Mfg. Co., Trenton, N. J.
Colonial Insulator Co., Akron, O.
Connecticut Porcelain Co., Trenton, N. J.
Cook Pottery Co., Trenton, N. J.
Corns China Co., Wellsville, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Globe Porcelain Co., Mulberry St. and St. Joes Ave., Trenton, N. J.
Hartford Faience Co., Hartford, Conn.
Hub-Way Mfg. Co., Hubbard, Ohio.
Illinois Electric Porcelain Co., Macomb, Ill.
Imperial Porcelain Wks., Canal and Mulberry, Trenton, N. J.
Knox Porcelain Corp., Knoxville, Tenn.
Louthan Mfg. Co., East Liverpool, O.
Mercer Porcelain Co., Trenton, N. J.
Metsch Refractories Co., East Liverpool, Ohio.
National Porcelain Co., Trenton, N. J.
New Jersey Porcelain Co., Trenton, N. J.
Nu Blac. See Star Porcelain Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y
Porcelava. See Burgess & Co.
Porcelain Products, Inc., Findlay, Ohio.
Square D Company, Detroit, Mich.
Standard Porcelain Co., Leetonia, O.
Standard & Specialty Porcelain Co., Sun Prairie, Wis
Star Porcelain Co., Muirhead St., Trenton, N. J.
Thomas & Sons Co., R., Lisbon, O.
Trenle Porcelain Co., East Liverpool, Ohio.
Union Elec'l Porcelain Wks., Inc., Trenton, N. J
Washington Porcelain Co., Washington, N. J.
Woolley, Inc., W. Douglas, East Liverpool, O.

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Hibernia Bank Bldg., New Orleans, La.
New Orleans to French and Belgian ports

YANKEE LINE
110 State Street, Boston, Mass.
North Atlantic ports to German ports

GULF WEST MEDITERRANEAN LINE
917 Whitney Building, New Orleans, La.
Gulf and South Atlantic ports to Portuguese, Spanish, and North African ports (west of Bizerta)

MOBILE OCEANIC LINE
Mobile, Ala.
Mobile and Eastern Gulf ports to United Kingdom and continental European ports

AMERICAN GULF ORIENT LINE
917 Whitney Bldg., New Orleans, La.
Gulf ports to Orient and Dutch E. I.

AMERICAN REPUBLICS LINE
33 Broad Street, Boston, Mass.
N. and S. Atl. ports to Brazil and River Plate ports, east coast of S. America

ORIOLE LINES
Citizens Natl. Bank Bldg., Baltimore, Md.
North Atlantic ports to west coast of United Kingdom and Irish ports

SOUTHERN STATES LINE
925 Whitney Central Building, New Orleans, La.
New Orleans and Texas ports to German and Holland ports

TEXAS MEDITERRANEAN LINE
Cotton Exchange Bldg., Galveston, Tex.
Texas ports to Mediterranean ports

TEXAS UKAY LINE
Galveston, Texas
Texas ports to United Kingdom ports

TEXAS STAR LINE
New Orleans, La.
Texas ports to French and Belgian ports

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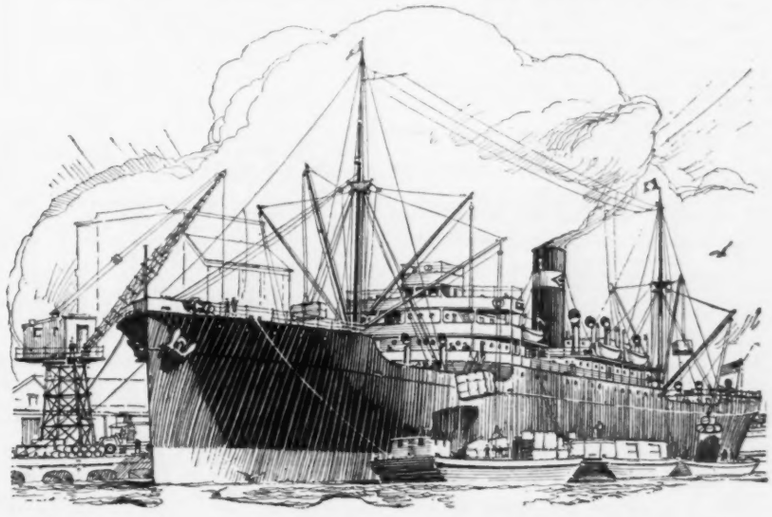

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Maddocks Sons, John, Trenton, N. J.
Ohio Pottery Co., Zanesville, Ohio.
Robinson Clay Products Co., Akron, Ohio.

POSTS, Binding
Binding Posts, Switch Parts, Stop Points, Contacts, Arms, Levers. See also Radio Mountings.
American Radio Hardware Co., 135 Grand, New York
Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
DeJur-Amsco Corp., 418 Broome, New York, N. Y.
Eby Mfg. Co., Inc., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
Grammes & Sons, Inc., L. F., Allentown, Pa
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
King. See Morse Co., Frank W.
Morse Co., Frank W., 289 Congress, Boston. (Spring Grip)
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Polk, J. L., 41 Bell Ave., Troy, N. Y.
Premier Elec. Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
Queen. See Morse Co., Frank W.
Thomaston Mfg. Co., Thomaston, Conn.
Waterbury Button Co., Waterbury, Conn.

POTENTIOMETERS (Instruments). See Instruments, Laboratory Standard.

POTENTIOMETERS (Radio Control). See Radio Receiver Parts.

POWDERED CARBON. See Carbon, Powdered.

POWER TRANSMISSION CHAIN. See Chain, Power Transmission.

PRESS BOARD. See Cloth and Paper.

PRESSES, Armature Coil
Comstock Mfg. Co., Wilkes-Barre, Pa.

PRESSES, ARMATURE NOTCHING. See Notching Machines, Armature.

PRESSES, Molded Insulation
Burroughs Co., 246 N. Tenth, Newark, N. J.
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Elmes Engrg. Works, Chas. F., 232 N. Morgan, Chicago, Ill.
Evans Engrg. Works, Chas. E., 1002 Fulton, Chicago, Ill.
Farquhar Co., A. B., York, Pa.
Southwark Fdy. & Mach. Co., 400 Washington Ave., Philadelphia, Pa.
Stokes Mach. Co., F. J., 5826 Tabor Rd., Olney, Philadelphia, Pa.
Terkelson Machine Co., 326 A, Boston, Mass.
Watson-Stillman Co., 75 West St., New York, N. Y
Wood & Co., R. D., Florence, N. J.

PRESSES, Porcelain Molding
Baird, Andrew, 2715 Newark, Detroit, Mich.

PRESSES, Punching
Bench Presses—Power Presses; for Punching & Stamping Sheet Metal.
Ams Machine Co., Max, 101 Park Ave., New York, N. Y.
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., 53rd St. & Second Ave., Brooklyn, N. Y.
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hyre Mfg. Co., 200 Varick, New York, N. Y.
Loshbough-Jordan Tool & Machine Co., Elkhart, Ind.
Peck, Stow & Wilcox Co., Southington, Conn.

PRISMS, Chandelier. See Crystals, Chandelier

PROJECTOR LENSES. See Lenses.

PULLERS, Armature Shaft
Motor Pulley, Shaft & Pinion Pullers & Extractors.
Allen Electric & Equipment Co., Kalamazoo, Mich.
Big Buster. See Premier Elec. Co.
Crane Puller Co., Waltham, Mass.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Company, Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Little Giant. See Premier Elec. Co.
Peerless. See Electric Service Supplies Co.
Premier Electric Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill

PULLEYS, Composition
General Electric Co., Schenectady, N. Y.
Rockwood Mfg. Co., Indianapolis, Ind.
Sprucolite Co., Bloomfield, N. J.

PUMPS, Oil Burner
Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago
Reflex. See Simplex Oil Heating Co.
Simplex Oil Heating Co., 1199 Eddy, Providence, R. I.
Teesdale Mfg. Co., 427 Market, Grand Rapids, Mich.
Zisch Engineering Co., 39 Ave. L, Newark, N. J.

PUMPS, Vacuum
To Exhaust Incandescent Lamps.
Arrow Machine Co., 527 Hackensack Plank Rd., Union City, N. J.
Beach-Russ Co., 50 Church, New York, N. Y.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Dunham Co., C. A., 450 East Ohio, Chicago, Ill.
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hubbard's Sons, Norman, 1 Carlton Ave., Brooklyn, N. Y.
Leiman Bros., 23 Walker, New York, N. Y.
Packard. See Hubbard's Sons, Norman.

PUNCHING PRESSES. See Presses, Punching.

PUNCHING and BENDING, Sheet Steel
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

RACKS, Wire Reel
(With Tension Device Attached).
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Elec'l Wks., P. E., 1828 Chouteau Ave., St. Louis, Mo. (Tensionless Dereeler)
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Elec. Co., Schenectady, N. Y. (Tension Indicator.)
Mutual Foundry & Machine Co., Atlanta, Georgia.
Segur. See Electric Service Supplies Co.

RADIO CIRCUIT COMPONENTS
This heading includes Inductances (Coils), Capacitors (Condensers), Fixed Resistances, Grid Leaks, Transformers, Choke Coils, and Filters, also Amplifier Units and Kits.
Acme Appar. Corp., 39 Osborne, Cambridge, Mass.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Ajax Elec. Specialty Co., St. Louis, Mo.
Alden Mfg. Co., Springfield, Mass.
All-American Mohawk Corp., 4201 Belmont Ave., Chicago, Ill.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Amerchoke. See American Transformer Co.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
American Transformer Co., Newark, N. J
Amperite Rheostat. See Radiall Co.
Areo Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arctic. See Premier Elec. Co.
Audioformer Transformer. See Pacent Electric Co.
Autoformer. See Thordarson Elec. Mfg. Co.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn,
B-Conomizer. See Pilot Elec. Mfg. Co.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bonine. See Turn-it Radio Sales.
Branston Co., Chas. A., 297 Washington, Buffalo, N. Y.
Bremer-Tully Mfg. Co., 520 S. Canal, Chicago, Ill.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
Browning-Drake Corp., 110 Brookline, Cambridge, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Elec. Mfg. Co.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Central Radio Corp., Beloit, Wis.
Centraline. See Pilot Elec. Mfg. Co.
Certified Condenser. See Radio Condenser Co.
Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago,
Cole Radio Mfg. Corp., 536 Bloomfield Ave., Bloomfield, N. J.
Columbia Metal Products Co., 360 E. Grand Ave., Chicago,
Concertone. See Chicago-Jefferson Fuse.
Connectoralds. See Alden Mfg. Co.
Continental Carbon, Inc., Cleveland, O.
Continental. See Gardiner & Hepburn, Inc.
Counterphase Kit. See Bremer-Tully Mfg. Co.
Crosradio Corp., 166-32 Jamaica Ave., Jamaica, N. Y.
Crafot. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
DeForest Radio Co., Jersey City, N. J.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 4377 Bronx Blvd., New York.
Dumont Elec. Co., 40 W. 17th, New York, N. Y.
Duratran. See Dubilier Condenser Corp.
Durham & Co., 1936 Market, Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York.
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc., 350 Madison Ave., New York, N. Y.
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
Equitrol. See Cardwell Mfg. Corp.
Euphonic. See Bremer-Tully Mfg. Co.
Excelsior Radio Corp., 216 Wallabout, Brooklyn, N. Y.
E-Z. See Polymet Mfg. Corp.
Faradon. See Wireless Specialty Apparatus Co.
Fast Co., John E., Crawford & Barry Ave., Chicago, Ill.
Ferranti, Inc., 130 W. 42nd, New York, N. Y.
Filatrol. See De Jur-Amsco Corp.
Filtrola. See All-American Mohawk Corp.
Flechtheim Co., A. M., 136 Liberty, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind.
F. H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa.
General Instrument Corp., 477 Broadway, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
General Transformer Corp., 900 W. Jackson Blvd., Chicago.
General Winding Co., 214 Fulton, New York, N. Y.
Gen-Win. See General Winding Co.
Glastor. See Daven Corp.
Globar Corp., Niagara Falls, N. Y.
Glo-Dial. See Wireless Radio Corp.
Gray & Danielson Mfg. Co., 260 1st, San Francisco, Cal.
Halldorsen Co., 4745 N. Western Ave., Chicago, Ill.
Hammarlund Mfg. Co., 424 W. 33rd, New York, N. Y.
Hardwick, Hindle, Inc., 122 Greenwich, New York, N. Y.
Harmonik. See Karas Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (TRF Kits.)
Heath & Co., Geo. W., 260 First Ave., Newark, N. J.
Hedgehog Transformer. See Premier Elec. Co.
Heinemann Elec. Co., Philadelphia, Pa.
Hi-Q Kit. See Hammarlund.
Hy-Wat. See Electro Motive Engineering Corp.
Igrad Condenser & Mfg. Co., 26 Avenue D, Rochester, N. Y.
Infra-Dyne. See Gray & Danielson Co.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Isograd, Isoleak. See Pilot Elec. Mfg. Co.
J-M-P Mfg. Co., 3329 Fond du Lac Ave., Milwaukee, Wis.
Karas Elec. Co., 4040 N. Rockwell, Chicago, Ill.
Kelford. See American Specialty Co.
Kenyon Transformer Co., 122 Cypress Ave., New York, N. Y.
Kilograd. See Pilot Elec. Mfg. Co.
Kroblack. See Mountford, C. E.
Kuprox. See Kodel Radio Corp.
Langbein-Kaufman Radio Co., 62 Franklin, New Haven, Conn.
Lavite. See Aerovox Wireles Corp.
Lautz Mfg. Co., 245 N. J. R. R. Ave., Newark, N. J.
Lekeless. See Benjamin Elec. Mfg. Co.
Lemnis. See General Winding Co.
L. M. C. See Lauts Mfg. Co.
Loftin-White. See Hammarlund Mfg. Co.
Loless. See Wireless Radio Corp.
Lynch, Arthur H., 1775 Broadway, New York, N. Y.
Marco. See Martin-Copeland Co.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Maxitran. See Electrical Research Laboratories.
Mayolian Corp., 1668 Webster Ave., New York, N. Y. (Tone Filter.)
Meggit. See Cole Mfg. Corp.
Melco-Supreme. See De Jur-Amsco Corp.
Melcoupler. See Robertson-Davis Co.
Meloformer. See Robertson-Davis Co.
Metaleak. See Dubilier Condenser Corp.
Metralign. See General Instrument Corp.

Micadon Condenser. See Dubilier Condenser Corp.
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y. (Amplifier Kit.)
Mica-Static. See Dubilier Condenser Corp.
Micon Condenser. See Dubilier Condenser Corp.
Microcondenser. See Sterling Mfg. Co.
Microgrid. See Pilot Elec. Mfg. Co.
Micrometric. See Karas Elec. Co.
Microstat. See Premier Elec. Co.
Midline. See Hammarlund Mfg. Co.
Modern Electric Mfg. Co., Toledo, O.
Mountford, C. E., 30 Sullivan, New York, N. Y.
Muter Co., Leslie F., 76th St. and Greenwood Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass.
Neutro-Grad. See Pilot Elec. Mfg. Co.
New York Coil Co., Mount Clare, Pa.
Nutmeg. See Hart & Hegeman Mfg. Co.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, O.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill. (Resistance.)
Orthometric. See Karas Elec. Co.
Orthophone. See De Jur-Amsco Corp.
Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
Panatrol. See Wireless Radio Corp.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Perry Elec'l Resistor Corp., 280 New Main St., Yonkers, N. Y.
Phastrol. See Electrad, Inc.
Philmore Mfg. Co., 106 7th Ave., New York, N. Y.
Piander. See De Jur-Amsco Corp.
Pierce Airo. See United Scientific Laboratories.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Pilotron. See Pilot Elec. Mfg. Co.
Potter Mfg. Co., North Chicago, Ill.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Power Box. See Scott Sales Co.
Powerohm. See International Resistance Co.
Powrad, Inc., 486 Johnson Ave., Brooklyn, N. Y.
Precision Coil Co., 122 Greenwich, New York, N. Y.
Precise Mfg. Corp., 254 Mill, Rochester, N. Y.
Premier Elec Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Protectoraid. See Alden Mfg. Co.
Pyrohm. See Aerovox Wireless Corp.
Radiall Co., 50 Franklin, New York, N. Y.
Radio Appliance Corp., Springfield, Mass.
Radio Condenser Co., Thorn & Copewood, Camden, N. J.
Radio Engrg. Laboratories, 100 Wilbur Ave., Long Island City, N. Y. (Short Wave Kit.)
Radioloc Switch. See Cutler-Hammer Mfg. Co.
Radio Receptor Co., 106 7th Ave., New York.
Radiostat. See Allen-Bradley Co.
Raola. See Modern Elec. Mfg. Co.
Rauland-Lyric. See All American Mohawk Corp.
Receptrad. See Radio Receptor Co.
Reesonator. See F. & H. Radio Laboratories.
Regal. See American Specialty Mfg. Co.
Reliable Parts Mfg. Co., Wellington, O.
Remler. See Gray & Danielson Co.
Resistaformer. See Aerovox Wireless Corp.
Resistograd. See Pilot Elec. Mfg. Co.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent), Hatheway & Co., 16 Hudson, New York, N. Y.
Roberts Condenser. See Hammarlund Mfg. Co.
Robertson-Davis Co., 412 Orleans, Chicago, Ill.
Samson Elec. Co., Canton, Mass. (TRF Kits.)
Sangamo Elec. Companies, Springfield, Ill.
Scanlan Elec. Mfg. Co., 1113 N. Franklin, Chicago, Ill. (Output Transformers.)
Scovill Mfg. Co., Waterbury, Conn.
Senior. See All American Mohawk Corp.
Sensory. See Heinemann Electric Co.
Sevison Magneto Engr. Co., 397 Phillips, Toledo, O.
Sickles Co., F. W., 130 Union, Springfield, Mass.
Signal Elec. Mfg. Co., Menominee, Mich.
Silver-Marshall, Inc., 846 W. Jackson Blvd., Chicago. (Amplifier Kits.)
Silvertone. See Radio Receptor Co.
S. L. S. See Wireless Radio Corp.
S. L. T. See General Instrument Corp.
Somersolo. See DeForest Radio Co.
Splitmeter. See Premier Electric Co.
Sprague Specialties Co., Dept. M., Quincy, Mass.
Standard Transformer Co., Warren, O.
Sta-Put. See Martin-Copeland Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, O.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Submariner. See J-M-P Mfg. Co.
Super Multiformer. See Precise Mfg. Corp.
Supertran Transformer. See Ford Radio & Mica Co.
Symphony. See Modern Elec. Mfg. Co.
Synerodenser. See Precise Mfg. Corp.
Tandem. See Bremer-Tully Mfg. Co.
Telemonic Coil. See Condenser Corp. of America.
Telos Coil. See Condenser Corp. of America.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago.
Tobe Deutschman Co., Canton, Mass.
Tone Control. See Sprague Specialties Co.
Toroid. See All American Mohawk Corp.
Torostyle. See Bremer-Tully Mfg. Co.
Transcript-Clapp Kit. See Samson Electric Co.
Truphonic Amplification. See Alden Mfg. Co.
Twin-aud. See Peerless Radio Co.
Twin-Eight Transformers. See Bodine Electric Co.
Two-Ten & Two-Eleven. See Silver-Marshall.
Tyrman Elec. Corp. 143 W. Austin Ave., Chicago, Ill.
Ultra Varlo. See Bruno Radio Corp.
Universier Condenser. See Auburn Button Works.
Universal Electro Chemical Corp., 30 W. 15th, New York.
Universal Winding Co., Boston, Mass.
Variall Condenser. See Muter Co.
Volta. See Universal Electro Chemical Corp.
Waterbury Button Co., Waterbury, Conn.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn, N. Y.
Wireless Specialty Apparatus Co. (J. P.), Boston, Mass.

RADIO HARDWARE. See Radio Mountings.

RADIO MOUNTINGS
Coil Mountings, Coil Sliders and Rods, Switches, Detectors, Detector and Grid Leak Mountings, Panel Brackets, Special Radio Hardware & Trimmings, Metal Dials, Metal Panels, etc.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Alden Mfg. Co., Brockton, Mass.
American Radio Hardware Co., 135 Grand, New York
Bonza. See Haydon & Haydon.
Carborundum Co., Niagara Falls, N. Y. (Detector.)
Chapman Machine Co., Terryville, Conn.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Durham & Co., 1936 Market, Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y. (Metal Panels.)
Eureka. See Morse Co Frank W.

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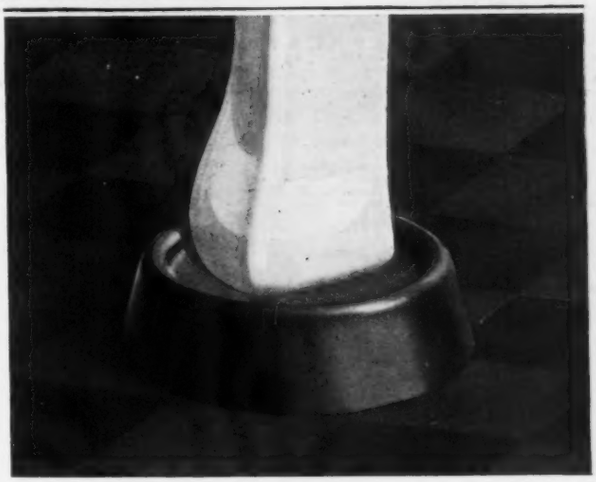

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Globe Technolian Corp., Reading, Mass.
Glodial. See Wireless Radio Corp.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Haydon & Haydon, 167 Chambers, New York, N. Y.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th and Greenwood Ave., Chicago.
Na-Ald. See Alden Mfg. Co.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Union Insulating Co., 296 Broadway, New York, N. Y.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO PANEL ENGRAVING. See Engraving, Radio Panel

RADIO RECEIVER PARTS

Rheostats, Sockets, Plugs, Jacks.
Acme Elec. & Mfg. Co., 1652 Rockwell, Cleveland, Ohio.
Alden Mfg. Co., Springfield, Mass.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Automotive Equipment Co., 317 Halsey, Newark, N. J.
B. M. S. See Brooklyn Metal Stamping Corp.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. (Multiple Plugs.)
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Brach Mfg. Corp., L. S., 120 Sussex Ave., Newark, N. J.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn.
Cabelug. See Jones, Howard B.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Also Socket Adapters.)
Central Radio Laboratories, 14 Keefe Ave., Milwaukee.
Centralab. See Central Radio Laboratories.
Clarostat Mfg. Co., 285 N. Sixth, Brooklyn, N. Y.
Cle-Ra-Tone. See Benjamin Elec. Mfg. Co.
D. A. Radio Co., 30 Hollister, Buffalo, N. Y.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
De Veau. See Stanley & Patterson.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Duostat. See De Jur-Amsco Corp.
E-Z. See Polymet Mfg. Corp.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I.
Fantail Plug. See Brooklyn Metal Stamping Corp.
Frost, Herbert H., 1142 W. Beardsley, Elkhart, Ind.
Gem-Jac. See Frost, Herbert H.
General Instrument Corp., 477 Broadway, New York, N. Y
General Radio Co., 30 State, Cambridge, Mass.
Gray & Danielson Mfg. Co., 260 First, San Francisco, Cal.
Hart & Hegeman, Div. of Arrow-Hert & Hegeman Elec. Co., Hartford, Conn.
Heinemann, Elec. Co., Philadelphia, Pa.
Imp. See Carter Radio Co.
Jones, Howard B., 2226 Wabansia, Chicago, (Multiple Plug.)
Klosner Radio Corp., 1022 E. 178th, New York, N. Y.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Modu-Plug. See Central Radio Lab.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th & Greenwood Ave., Chicago.
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Pacent Elec. Co., 91 Seventh Ave., New York, N. Y.
Pan-Tab Jack. See Frost, Herbert H.
Philmore Mfg. Co., 106 Seventh Ave., New York, N. Y
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Premier Elec. Co., Dept. 1323, 3800 Ravenswood Ave., Chicago, Ill.
Recto Mfg. Co., 23 W. Third, Cincinnati, Ohio
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Royalty. See Electrad, Inc.
Samson Elec. Co., Canton, Mass.
Socostat. See D. A. Radio Co.
Stanley & Patterson, 150 Varick, New York, N. Y.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio
Tubestat. See Muter Co.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO RECTIFIER TUBES

Armstrong Elec. & Mfg. Co., 251 Halsey, Newark, N. J
Cable Supply Co., 80 Union Square, New York, N. Y.
Ceco Mfg. Co., 702 Eddy, Providence, R. I.
Conneway Elec. Laboratories, 406 Jefferson, Hoboken, N. J
Cunningham, Inc., E. T., 370 Seventh Ave., New York, N. Y.
DeForest Radio Co., Franklin St. & Central Ave., Jersey City, N. J.
Diamond Vacuum Products Co., 4053 Diversey Ave., Chicago
Gold Seal Electrical Co., 250 Park Ave., New York, N. Y.
Manhattan Elect. Supply Co., 17 Park Pl., New York, N. Y.
Northern Mfg. Co., 367 Ogden, Newark, N. J.
Paramount Mfg. Co., 79 Orange, Newark, N. J.
Perryman Electric Co., 33 W. 60th, New York, N. Y.
Radio Corp. of America, 233 Broadway, New York.
Raytheon Mfg. Co., Kendall Square Bldg., Cambridge, Mass.
Sonatron Tube Co., 108 W. Lake, Chicago, Ill.
Specialty Appliance Co., 6611 Euclid Ave., Cleveland, Ohio
Sylvania Products Co., Emporium, Pa.
Telecoil Corp., 583 Twelfth, West New York, N. J.
United Radio & Elec. Corp., 500 Chancellor Ave., Irvington N. J.

RADIO TRANSFORMERS. See Radio Circuit Components
RADIO TUBE BASE BRANDERS. See Engraving Radio Panel.
RADIO TUBE BASES. See Radio Molded Parts.
RADIO TUBE BULBS (Unfinished). See Bulbs, Glass.

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Special wiring cable and harness assemblies for radio battery connections, radio tube adapter harness for converting battery operated receivers to A.C. operation; Socket Adapters for Power Tubes; Loud Speaker Extension Cords—This heading also includes auto ignition assemblies.
Afco. See American Fabric Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alden Mfg. Co., Brockton, Mass. (Adapters.)
Alpbus. See Alpha Radio Supply Co.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Alpstrand. See Alpha Radio Supply Co.
American Braiding Co., Holyoke, Mass.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Birnbach Radio Co., 254 W. 31st St., New York, N. Y.
Blue Ribbon. See Crescent Braid Co.
Brach Mfg. Co., L. S., Newark, N. J.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Adapters.)
Connectoraids. See Alden Mfg. Co.
Cornish Wire Co., 30 Church, New York, N. Y.
Corwico. See Cornish Wire Co.
Crescent Braid Co., Providence, R. I.
Crescent Insulated Wire & Cable Co., Trenton, N. J.
De Luxe, 50 W. Houston, New York, N. Y.
Echo. See Cornish Wire Co.
Enterprise Mfg. Co., Third & Dauphin Sts., Philadelphia, Pa. (Adapters).
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind. (Adapters.)
Lusterized. See American Braiding Co.

Manhattan Insulated Wire Co., 17 W. 60th St., New York.
Morse Co., Frank W., Boston, Mass.
Power, Inc., Harold J., Medford Hillside, Mass. (Adapters).
Radio Receptor Co., 106 Seventh Ave., New York, N. Y. (Adapters.)
Riga. See Birnbach Radio Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio. (Adapters).
Wilkens Mfg. Co., 52 Orawaupun St., White Plains, N. Y.

RADIUM POWDER AND PAINT

Radium Dial Co., 3332 Forbes, Pittsburgh, Pa.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y.

RANGE SWITCHES, Rotary Snap. See Switches, Snap, Heavy Duty.
RAWHIDE GEARS. See Gears & Pinions, Rawhide.
READING LAMP BASES. See Bases, Reading Lamp.
REAMERS, Pipe. See Stocks, Dies and Reamers.
RECEPTACLES, Lamp. See Sockets and Receptacles.

RECEPTACLES, Plug, Heavy Duty

	KEY
Battery Charging	See B
Floor Boxes	See F
Welding	See W
Machine Tool	See W
Watertight, Marine, Mine	See M
Car Trailer Connection	See C
Extension	See E

A. B. C. See Andersen Mfg. Co.
Adam Electric Co., Frank, St. Louis, Mo. F
Adapti Co., 2996 E. 72nd, Cleveland, O.. F
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass. B W M C E
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill. M
Arktite. See Crouse-Hinds Co.
Arnesam Electric Co., 13 Water, New York M
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.. F B W
Auth Electrical Specialty Co., 422 E. 53rd, New York, N. Y. E
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill. F .. W M
Bryant Elec. Co., Bridgeport, Conn. (Also Range Type.) W
Campbell. See Steel City Elec. Co.
Cannon Elec. Development Co., 420 West Ave., 33, Los Angeles, Cal. F
C. E. M. Co. See Conn. Elec. Mfg. Co.
C. H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. M
Conduletto. See Crouse-Hinds Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. F
Cory & Son, Chas., 183 Varick, New York M
Crouse-Hinds Co., Syracuse N. Y. B W
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis. F
Delta-Star Elec. Co., 2433 Fulton, Chicago W M
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa. C
Elwell Parker Elec. Co., 4229 St. Clair Ave., N. E., Cleveland, O. B
Fielding. See Stanley & Patterson.
Fountain's See Jenkins Mfg. Co.
Fullman Mfg. Co., Latrobe, Pa. F
Fullman. See Steel City Elec. Co.
General Elec. Co., Section W-232, Merchandise Dept., Bridgeport, Conn. B
Gleason & Co., J. L., 241 Franklin, Boston, Mass. E
H. & H. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. B W
Hessel Co., W. F., 76 Greenwich, New York, N. Y. W M E
Hubbell, Inc., Harvey, Bridgeport, Conn. (Also Range Type.) B W
Indestructible. See Kliegl Bros. Universal.
Jenkins Mfg. Co., Bloomfield, N. J. E
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. F B W M
Latrobe. See Fullman Mfg. Co.
Loeffelholz & Co., Milwaukee, Wis. C
Major Equipment Co., 4603 Fullerton Ave., Chicago, Ill. M
McPage McKenny Co., Armour Bldg., Seattle, Wash. F
Novelty Elec. Co., Tenth & Cherry Sts., Philadelphia, Pa. C
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio W
Ostrander Elect. Works, W. R., 911 Atlantic Ave., Brooklyn, N. Y.
Preset. See Walker Bros. Co.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill. W M C E
Quadrangle Mfg. Co., 30 S. Peoria, Chicago, Ill. (Combination wall bracket and convenience outlet.)
Raleo Mfg. Co., 123 N. Albany Ave., Chicago, Ill. E
Russell & Stoll Co., 53 Rose, New York F B W M
Square D. Co., Detroit, Mich. W
Stanley & Patterson, 150 Varick, New York, N. Y. F
Steel City Elec. Co., Pittsburgh, Pa.. F E
Thomas & Betts Co., 15 Park Place, New York, N. Y. F
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa. M
Walker Bros., 1417 Sansom, Philadelphia F E
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. F B W M
Yale. See Electric Products Co.

RECORDERS, Elapsed Time. See Indicators, Operation.
REDUCERS, Socket. See Socket Reducers.
REFLECTOR LENSES. See Lenses.

REFLECTORS, Porcelain Enameled, Steel

Bolite Reflector Co., 7500 Sherman Ave., Cleveland, O.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Cello, Inc., 96 Prince, New York, N. Y.
Dunlap Co., John, Carnegie, Pa.
Durez. See Wheeler Reflector Co.
Federal Electric Co., 8700 S. State, Chicago, Ill.
Goodlites. See Goodrich Elec. Co.
Goodrich Elec. Co., 1650 Ogden Ave., Chicago, Ill.
Isolux. See Wheeler Reflector Co.
Ivanhoe Division of Miller Co., Cleveland.
Marbelite Art Products Co., 140 N. Robey, Chicago, Ill.
Maxolite See Raleo Mfg. Co.
Monk, H. E., 18 Warren, New York, N. Y.
Multi Elect. Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Oamed. See Overbaugh & Ayers.
Overbaugh & Ayers, 411 S. Clinton, Chicago, Ill.
Para Steel. See Wheeler Reflector Co.
Perfection. See Tindall & White.
Philadelphia Elec'l & Mfg. Co., 1228 N. 31st, Philadelphia.
Quad. See Quadrangle Mfg. Co.
Quadrangle Mfg. Co., 30 S. Peoria, Chicago Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Sturdox. See Benjamin Elec. Mfg. Co.
Tindall & White, 33 W. 60th, New York, N. Y.
Vaporlux. See Wheeler Reflector Co.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Wheeler Reflector Co., 275 Congress, Boston, Mass.

REFRIGERANTS. See Chemicals, Refrigeration.
REFRIGERATION CHEMICALS. See Chemicals, Refrigeration.

REFRIGERATOR CABINETS

Airtite. See Rhinelander Refrigerator Co.
Alaska Refrigerator Co., Muskegon, Mich.
Allen Filter Co., 25 S. St. Clair, Toledo, O. (Water Cooler Unit.)
American Refrigerator Corp., Peru, Ind.
Argus Products Co., 174 E. Water, Portland, Ore.
Arlington Refrigerator Co., Arlington, Vt.
Athermos. See Gurney Refrigerator Co.
Automatic. See Illinois Refrigerator Co.
Baldwin Refrigerator Co., Burlington, Vt.
Banta Refrigerator Co., Clearfield, Pa.
Belding-Hall ElectrICE Corp., Belding, Mich.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bohn Refrigerator Co., St. Paul, Minn.
Castle Double-Servis. See Home Products Corp.
Cavalier. See Tennessee Furniture Co.
Challenge Refrigerator Co., Grand Haven, Mich.
Champion Refrigerator Co., 206 Lexington Ave., New York, N. Y.
Cold Storage Refrigerator Co., Eau Claire, Wis.
Crystal Refrigerator Co., Fremont, Neb.
Crysteel. See Benjamin Elec. Mfg. Co.
Dillingham Mfg. Co., Sheboygan, Wis.
Dry-Air. See Baldwin Refrigerator Co.
Dry-Cold. See Hill & Co.
Economic. See Leonard Refrigerator Co.
Eddy & Sons Co., D., 336 Adams, Boston, Mass.
Erie Art Metal Co. & Erie Metal Furniture Co., Erie, Pa.
General Necessities Corp., General Necessities Bldg., Detroit, Mich.
Gibson Refrigerator Co., Greenville, Mich.
Gloekler Co., Bernard, 1627 Penn Ave., Pittsburgh, Pa.
Gurney Refrigerator Co., Fond du Lac, Wis.
Harder Refrigerator Corp., Cobleskill, N. Y.
Haskelite Mfg. Co., 120 S. La Salle, Chicago, Ill. (Knockdown.)
Heintz Mfg. Co., Front & Olney Aves., Philadelphia, Pa.
Heinz & Munschauer, Superior and Randall, Buffalo, N. Y.
Herrick Refrigerator Co., 1805 River, Waterloo, Iowa.
Hibbard Cabinets, Inc., 6504 Euclid Ave., Cleveland, O.
Hill & Co., C. V., 360 Pennington Ave., Trenton, N. J.
Holderle Bros., Inc., 339 Exchange, Rochester, N. Y.
Home Products Corp., Jackson, Mich.
Howe Scale Co., Rutland, Vt.
Iceberg. See Dillingham Mfg. Co.
Iceless Cooler Corp., 225 N. Michigan Ave., Chicago, Ill. (Ice Cream Cabinets.)
Illinois Refrigerator Co., Morrison, Ill.
Jewett Refrigerator Co., Buffalo, N. Y.
Kingston. See Lorillard Refrigerator Co.
Kleen Kold. See Harder Refrigerator Corp.
Knox Products Co., Fourth & Greenhill Ave., Wilmington, Del.
Knox. See Erie Art Metal Co.
Leonard Refrigerator Co., Div. of Electric Refrigeration Corp., Grand Rapids, Mich.
Ligonier Refrigerator Co., Ligonier, Ind.
Liver & Co., C. B., Omaha, Neb.
Loeber Co., Henry G., 151 E. 126th, New York, N. Y. (Ice Cream Cabinet.)
Lorillard Refrigerator Co., 44 Cooper Square, New York.
Louisville Refrigerator Corp., 4460 Louisville Ave., Louisville, Ky.
Louisville Tin & Stove Co., Louisville, Ky.
Mace & Co., L. H., 55 E. 150th, New York, N. Y.
Maine Mfg. Co., Nashua, N. H.
McCray Refrigerator Sales Corp., 2864 Lake St., Kendallville, Ind.
Mowatt Refrigerator Co., 25 Oak Grove, San Francisco, Cal.
Omaha Fixture & Supply Co., 11th and Douglas, Omaha
Oreole. See Ottenheimer Bros.
Ottenheimer Bros., Baltimore, Md.
Plymetl. See Haskelite Mfg. Co.
Ranney Refrigerator Co., Greenville, Mich.
Reol. See Ottenheimer Bros.
Reolite. See Ottenheimer Bros.
Revolvo. See Iceless Cooler Corp.
Rex Mfg. Co., Connersville, Ind.
Rexdale. See Rex Mfg. Co.
Rhinelander Refrigerator Co., Rhinelander, Wis.
Saco-Lowell Shops, Newton Upper Falls, Mass.
Sanitary Refrigerator Co., Fond du Lac, Wis.
Schmidt Co., C., John and Livingston, Cincinnati, O.
Seeger Refrigerator Co., St. Paul, Minn.
Sherer-Gillett Co., 601 W. Washington, Chicago, Ill.
Steeprest. See Heintz Mfg. Co.
Success Mfg. Co., Gloucester, Mass.
Tennessee Furniture Co., Chattanooga, Tenn.
Vogt. See General Necessities Corp.
Ward Refrigerator Co., 6901 S. Alameda, Los Angeles, Cal.
White Mountain. See Maine Mfg. Co.
White Seal. See Louisville Refrigerator Co.

REFRIGERATOR CONDENSER UNITS. See Condenser Units, Refrigerator.

REFRIGERATOR FITTINGS

Commonwealth Brass Corp., 5781 Commonwealth Ave., Detroit, Mich.

RELAYS

(See also Circuit Breakers and Thermostats.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
Struthers Dunn, Inc., 1133 Race, Philadelphia, Pa.
Wilcolator Co., 17 Nevada, Newark, N. J.

REMOTE CONTROL SWITCHES. See Switches, Remote Control.

REMOVERS, Coil

Ewing Mfg. Company, Middleport, Ohio.

RESISTANCE

Boxes. See Instruments, Laboratory Standard
Coil Cores. See Cores, Resistance.
Test Sets. See Instruments.
Units, Radio See Radio Circuit Components.
Units. See Units, Rods & Grids.
Wire. See Wire Bare.

RESISTORS

Lautz Mfg. Co., 245 N. J. R.R. Ave., Newark, N. J.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ward-Leonard Electric Co., Mount Vernon, N. Y.

RESISTORS. See Units, Rods & Grids.
REVOLUTION COUNTERS. See Tachometers.

LAVA

INSULATORS

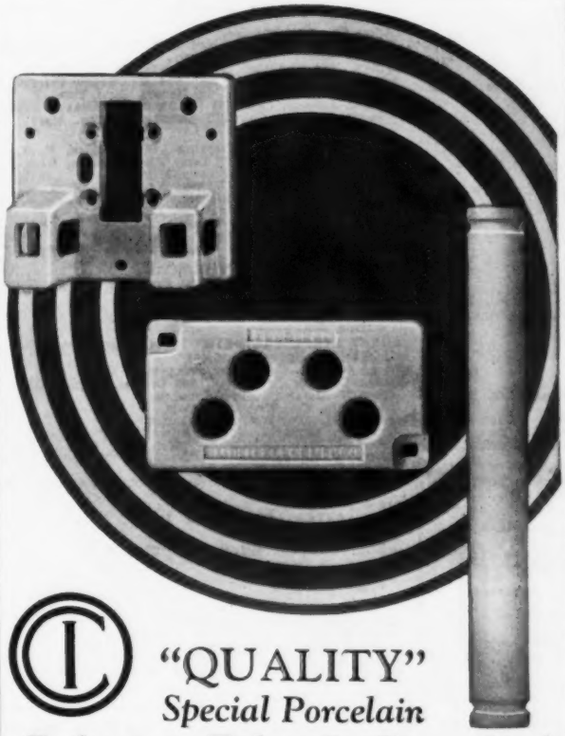
Manufacturers adopt Lava because, in the manufacture of electrical appliances, the properties of Lava insure dependable parts. Made to special design each Lava insulator becomes an important component part of the finished product.

AMERICAN LAVA CORPORATION

1425 William St. Chattanooga, Tenn.

Manufacturers of

HEAT RESISTANT INSULATORS



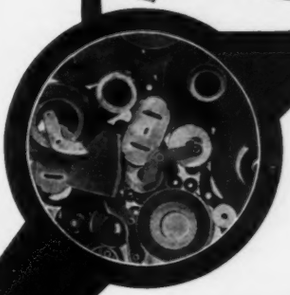
"QUALITY"

Special Porcelain

Refractory Tubes for Every Use

COLONIAL INSULATOR CO.

Akron, Ohio *Established 1892*



The half inch FIBROC strip above is 1/16" thick. Note how flexible it is—no surface cracking.

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for Cold Punching

FOR those manufacturers who punch their own insulating parts, Fibroc has solved their punching problem with a flexible material having all the superior qualities common to other grades of Fibroc, mechanical strength, dielectric strength and stability—yet it may be punched cold in thicknesses up to 3/32" with perfectly smooth edges.

Whether you purchase your small insulating parts complete to specifications and ready for assembly, or whether you punch them yourself—you will find Fibroc an ideal and economical material for practically any insulating purpose.

The Fibroc plant turns out millions of punched parts of intricate design every month, and is splendidly equipped to meet your requirements, regardless of size or quantity.

Let the Fibroc engineers show you how Fibroc may be used to advantage in your product. Specify FIBROC on your blue prints.

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FIBROC INSULATION CO.

245 Lincoln Avenue

VALPARAISO, IND.

RHEOSTATS,
Motor-Controlling. See Controllers, also Rheostats.
Radio. See Radio Receiver Parts.
Sewing Machine. See Controllers.

RHEOSTATS

KEY

Battery Charging ..... See B
Stage Dimming ..... See D
Meter Testing (Laboratory) ..... See L
Plating Tank ..... See P
Motion Pictures (Projector Lamp) ..... See M
Motor Starting, Field and Speed Regulating. See F

	F	B	D	P	M	L
Allen-Bradley Co., 494 Reed, Milwaukee						L
Biddle, James G., 1211 Arch, Philadelphia						L
Brach Mfg. Corp., L. S., Newark, N. J. (Radio Battery Control.)		B				
Bradleystat. See Allen-Bradley Co.						
Controlite. See Ward Leonard Elec. Co.						
Crown Rheostat & Supply Co., 1910 Park Ave., West Chicago, Ill.				P		
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.	F	B	D			L
Economic Rheostat Switch Co., 3551 N. 5th, Philadelphia, Pa.	F					
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.	F					
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O.		B				
General Electric Co., Schenectady, N. Y.	F					L
Hanson-Van Winkle-Munning Co., Matawan, N. J.				P		
Holzmuller, C. J., 1108 Howard, San Francisco, Cal.			D			
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y.			D		M	
Knoeller Elec. Co., De Pere, Wis.	F					
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago	F	B	D		M	L
Optimus. See Hanson-Van Winkle-Munning Co.						
Robertson, Leo F., 536 W. 22nd, New York, N. Y.					M	
Rubicon Co., 29 W. Sixth, Philadelphia, Pa.						L
Schaefer Bros. Co., 1059 W. 11th, Chicago		B				
Simplicity. See Cutler-Hammer Mfg. Co.						
Union Elec. Mfg. Co., Milwaukee, Wis.	F					
Universal. See Ward Leonard Elec. Co.						
Vitrohm. See Ward Leonard Elec. Co.						
Ward Leonard Elec. Co., Mt. Vernon, N. Y.	F		D		M	
Watton. See Electric Products Co.						
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.	F				M	

RINGS Seal. See Packing.

RIVETS

Chase Brass & Copper Co., Waterbury, Conn.
Chicago Rivet & Specialty Co., 1830 S. 54th, Chicago, Ill.
Hassall, Inc., John, 402 Oakland, Brooklyn, N. Y.
Hungerford Brass & Copper Co., Div. of The Chase Brass Companies, Inc., 88 Lafayette, New York, N. Y.
Manufacturers Belt Hook Co., 1315 W. Congress, Chicago, Ill.
Merwin Mfg. Co., Bridgeport, Conn. (Solid & Tubular).
Nelson Rivet Co., Taunton, Mass.
Stimpson Co., Edwin B., 70 Franklin Ave., Brooklyn, N. Y.
Thomson Mfg. Co., Judson L., Waltham, Mass.
Tubular Rivet & Stud Co., 57 Lincoln, Boston, Mass.
Waterbury Brass Goods Co., Waterbury, Conn.
Wright & Corson Mfg. Co., Bridgeport, Conn.

RODS, Resistance. See Units, Rods and Grids.
ROLLER BEARINGS. See Bearings, Ball and Roller.

ROLLS, Coil Flattening

Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

RUBBER BELTS. See Belts, Rubber.

RUBBER, Hard

Hard Rubber, Ebonite, Vulcanite.
Aetna Rubber Co., 815 E. 79th, Cleveland, O.
American Hard Rubber Co., 11 Mercer, New York, N. Y.
Connecticut Hard Rubber Co., West Haven, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Luzerne Rubber Co., Murhead, near Dewey, Trenton, N. J.
Mahoganite. See American Hard Rubber Co.
New York Hard Rubber Turning Co., 212 Centre, New York.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Radiolite. See Superior Hard Rubber Co.
Stokes Rubber Co., Trenton, N. J.
Superior Hard Rubber Co., Butler, N. J.
U. S. Rubber Co., 1790 Broadway, New York, N. Y.
Vulcanized Rubber Co., 251 4th Ave., New York, N. Y.
Vulco Panels. See Vulcanized Rubber Co.

RUBBER, MECHANICAL GOODS

Goodrich Rubber Co., B. F., Akron, O.
Republic Rubber Co., Youngstown, O.

RUBBER, SEMI-HARD. See Rubber Mechanical Goods.

RUBBER, Sponge

Voyeraft Rubber Co., Ashland, O.

RUBBER TAPE. See Tape, Rubber and Friction.
RUBBER TUBING. See Tubing, Rubber.
RUST PROOFING. See Plating & Finishing.
SAL AMMONIAC. See Chemicals, Battery.
SALTS, Battery. See Chemicals, Battery.
SATURATING TANKS. See Wire Manufacturing Machines
SCREW SHELLS, Socket. See Shells, Screw Socket.

SCREW DRIVING MACHINES

Vim Electric Tool Co., 149 Broadway, New York, N. Y.

SCREW MACHINE PRODUCTS

Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh, Pa.
Barnes Co., Wallace, Bristol, Conn.
Blake & Johnson Co., Waterbury, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Brighton Screw & Mfg. Co., 1456 Harrison Ave., Cincinnati, O.
Celoron Co., Bridgeport, Pa.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Colonial-Premier Co., 225 W. Ohio, Chicago, Ill.
Eureka Tool & Machine Co., Newark, N. J.
Farles Mfg. Co., Decatur, Ill.
Hubbell, Inc., Harvey, Bridgeport, Conn.

Screw Machine Products
UP TO 2¼ in. DIAMETER
OLSON MFG. CO.
56 Commerical St.
WORCESTER, MASS.

Indianapolis Screw Products Co., 621 N. Noble, Indianapolis, Ind.
Linden & Co., 891 Broad, Providence, R. I.
Meisel Press Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Olsen Mfg. Co., 56 Commercial, Worcester, Mass.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Steiner & Co., 297 Washington, Newark, N. J.
Thomaston Mfg. Co., Thomaston, Conn.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Wilmington Fibre Specialty Co., Wilmington, Del.

SCREWS, Cap (Cut Thread)

Bristol Co., Waterbury, Conn.
Hartford Machine Screw Co., Hartford, Conn.

SCREWS, Drive

Parker-Kalon Corp., 190 Varick, New York, N. Y.

SCREWS, Machine

Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Hubbell, Inc., Harvey, Bridgeport, Conn.
New England Screw Co., Dept. A, 44 Farnsworth, Boston.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Strong, Carlisle & Hammond, 1392 W. Third, Cleveland, O.

SCREWS, Machine (Cut Thread)

American Screw Co., Providence, R. I.

SECOHMMETERS. See Instruments, Laboratory Standard.
SEGMENTS. See Discs, Armature.

SEPARATORS, Storage Battery

Baltimore Battery Separator Co., Baltimore, Md.
Campbell Elec. Co., Kansas City, Mo.
Carlile & Doughty, 2530 N. Broad, Philadelphia, Pa.
Chattanooga Battery Box Co., Chattanooga, Tenn.
Certified. See Ermet Products Co.
Consumers Rubber Co., 1302 Ontario, Cleveland, O.
Ermet Products Co., Sherman Drive & 16th, Indianapolis, Ind. (Wood.)
Estes & Sons, E. B., 25 Vanderbilt Ave., New York. (Wood.)
Indianapolis Box & Separator Co., 1450 E. 19th St., Indianapolis, Ind. (Wood.)
Indianapolis Mfg. Co., Indianapolis, Ind.
Inseco. See Indianapolis Box & Separator Co.
Link & Beamrick, Inc., 555 W. 52nd, New York, N. Y.
Red Band. See Indianapolis Mfg. Co.
Stewart Mfg. Co., Wm. E., 14th & Elm, Flint, Mich. (Wood.)
Wick Lumber Co., R., 539 W. 52nd, New York. (Wood.)

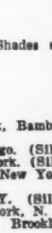
SHADES

Aluminum. See Shades, Metallic.
Asbestos. See Shades, Fabric.
Bamboo. See Shades, Fabric.
Brass. See Shades, Metallic.
Cast Metal. See Shades and Domes.
Copper. See Shades Metallic.
Cretonne. See Shades, Fabric.
Leaded. See Shades and Domes.
Leather. See Shades, Fabric.
Linen. See Shades, Fabric.
Mica. See Shades, Mica.
Molded. See Molded Insulation.
Mosaic. See Shades and Domes.
Paper. See Shades, Fabric.
Parchment. See Shades, Fabric.
Silk. See Shades, Fabric.
Stamped Metal. See Shades, Metallic; also Shades and Domes.
Steel. See Shades, Metallic.
Tin. See Shades, Metallic.
Zinc. See Shades, Metallic.

SHADES, Fabric

Asbestos Cretonne, Leather, Linen, Paper, Silk, Bamboo, Parchment.
Acme Lamp Shade Co., 630 W. Madison, Chicago. (Silk.)
Adelphi Lamp Shade Co., 242 Fifth Ave., New York. (Silk.)
Admiration Lamp Shade Co., 160 Madison Ave., New York, N. Y. (Silk.)
Andrews Co., C. M., 32 E. 30th, New York, N. Y. (Silk.)
Art Lamp Shade Studios, 316 Fifth Ave., New York, N. Y.
Audrey Art Shade Studios, 105 Thatford Ave., Brooklyn.

SCREW MACHINE PRODUCTS AND SPRINGS
for every purpose
WILLIAM STEINEN & COMPANY
297 Washington St. Newark, N. J.



Block & Co., L. D., 37 E. 18th St., New York, N. Y.
Borghese. See Hall, Chas.
Daiger Co., Charles V., 76 Essex, Boston, Mass. (Silk.)
Eastern Art Shop, 14 W. 19th, New York. (Parchment.)
Foss Parchment Shade Studio, 1338 E. 12th, Oakland, Cal. (Parchment.)
Foslite. See Foss Parchment Shade Studio.
Frostelene. See Art Lamp Shade Studios.
Gibson Art Co., 223 W. Fourth, Cincinnati, Ohio. (Paper.)
Hall, Chas., 3 E. 40th, New York, N. Y. (Paper Parchment.)
Hanson Co., Paul, 15 E. 26th, New York, N. Y. (Chintz.)
Harris Mfg. Co., 122 University Place, New York, N. Y. (Parchment.)
Herco Art Mfg. Co., Meriden, Conn.
Hoft Studio, 46 W. 21st, New York, N. Y. (Parchment.)
Idealite Elec. Lamp Shade Mfg. Co., 7 E. 17th, New York, N. Y. (Parchment.)
Kapa Shell. See Wardwell, E. H.
Kerwin. See Hall, Chas.
Kno-Glair. See Hamilton, M. E.
Lamb Bros. & Greene Corp., Napannee, Ind. (Silk.)
Luxrite. See John H. St. John.
Maxwell-Ray Co., Milwaukee, Wis. (Silk.)
Monarch Lamp & Shade Co., 210 N. Second, Philadelphia, Pa. (Silk.)
Morimura Bros., 58 W. 23rd, New York. (Bamboo, Silk, Cretonne.)
Parchment Novelty Co., 87 E. 10th, New York, N. Y. (Parchment.)
Patent Lamp Shade Co., 1361 Franklin Ave., Philadelphia.
Peerless Lamp Shade Mfg. Co., 114 E. 25th, N. Y. (Silk.)
R. D. Electric Co., Fort Wayne, Ind. (Linen and Silk.)
Reuter, Wm., 32 W. 34th, New York, N. Y. (Silk.)
Rindsberger Mfg. Corp., 22 E. 24th, Chicago, Ill.
Rosita Studio, 10 W. 28th, New York, N. Y. (Parchment and Leatherette.)
Sanderson's Art Co., Milwaukee, Wis. (Parchment.)
Springel & Son, A., 26 S. 3rd, Philadelphia, Pa.
St. John, John H., 1298 Atlantic Ave., Brooklyn, N. Y. (Silk.)
Straus-Hohenstein Co., 133 W. 21st, New York. (Silk.)
Superior Lamp Shade Manufacturers, 72 Madison Ave., New York, N. Y. (Silk.)
Tapestrelle Corp., 44 E. 29th, New York, N. Y.
Tombs Studios, Wm. H., 172 Pennsylvania Ave., Newark, N. J. (Parchment Paper.)
Trio Mfg. Co., 610 N. American, Philadelphia, Pa. (Silk.)
Troy Art Studio, 624 2d Ave., Troy, N. Y.
Utility Shade Co., Tenafly, N. J.
Vogue Lamp & Shade Co., 130 W. 17th, New York, N. Y. (Parchment.)
Volkman Co., 3223 W. Lake, Chicago, Ill.
Wardwell, E. H., 11 E. 36th, New York, N. Y.

SHADES AND DOMES

Leaded, Mosaic or Figured, Stamped or Cast Metal.
Art Shade Co., 223 N. Desplaines, Chicago, Ill.
Badanes Mfg. Co., 62 Greene, New York, N. Y.
Bayley & Sons, 105 Vanderveer, Brooklyn, N. Y.
Mutual Sunset Lamp Co., 21 E. Houston, New York, N. Y.
Royal Art Glass Co., 2572 Park Ave., New York, N. Y.
Western Art Glass Shade Works, 101 Turk, San Francisco.

SHADES, FACTORY WINDOW. See Window Shades, Factory.

SHADES, Metallic

Tin, Aluminum, Brass, Copper, Zinc, Steel.
A. A. Elec. Mfg. Co., Bridgeport, Conn. (Sole selling agent, Harry Pickhardt, 129 W. 15th, New York, N. Y.)
Durex. See Wheeler Reflector Co.
Farles Mfg. Co., Decatur, Ill. (Brass, Aluminum, Tin, Copper.)
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. (Aluminum, Brass, Zinc, Iron, Steel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Aluminum, Brass, Steel, Tin.)
Miller Co., Meriden, Conn.
Monk, H. E., 18 Warren, New York, N. Y. (Tin, Aluminum, Brass, Copper, Zinc & Steel).
Oamco. See Overbaugh & Ayres Mfg. Co.
Overbaugh & Ayres Mfg. Co., 411 S. Clinton, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Western Reflector Co., 1221 W. Madison, Chicago. (Tin.)
Wheeler Reflector Co., 275 Congress, Boston, Mass.

SHADES, Mica

Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
Kant-Krack. See Huse Liberty Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Tarmilite. See Tar Heel Mica Co.

SHAFT COUPLINGS. See Couplings, Shaft.
SHAFTS, Flexible. See Tubing, Flexible Metallic.

SHAPING MACHINES, Coil

Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio

SHEARS, Insulation

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.

SHEET STEEL CABINETS. See Cabinets, Sheet Steel.

SHELLS, Screw Socket

Chase Brass & Copper Co., Waterbury, Conn.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
Patton-MacGuyer Co., Providence, R. I.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Torrington Mfg. Co., 70 Franklin, Torrington, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., 800 S. Main, Waterbury, Conn. (Miniature.)

SHUNTS, Instruments. See Instruments, Laboratory Standard.
SIGN FLASHERS. See Flashers, Sign.
SIGN LETTER LENSES. See Lenses.

SILICA

Ottawa Silica Co., Ottawa, Ill. "Flint Shot."

SILK, Cloth Insulated. See Cloth & Paper.
Shades. See Shades, Fabric.
Tape. See Tape.
Thread. See Yarn, etc.

SILVER, Metal and Wire

Baker & Co., Inc., 54 Austin, Newark, N. J.
Handy & Harman, 57 William, New York, N. Y.
Wilco. See Wilson Co., H. A.
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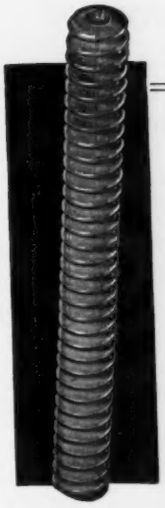

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Onan, David W., 43 Royalstone Ave., Minneapolis, Minn
Peerless. See Electric Service Supplies Co.
Ransom & Randolph Co., Superior & Chestnut, Toledo, Ohio
Simplex. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.
SNAP SWITCHES. See Switches, Snap

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Duplex. See Warner Bros. Co.
Eade, John E., 104 Point, Providence, R. I. Links, Insulators
Easylite. See Rittenhouse Co., A. E.
Economy. See Harvey Hubbell, Inc.
Flory, Wm. E., 38 W. 32nd, New York, N. Y. (Decorative Pull Chains.)
Gripper. See Wittenberg Bros.
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Palste. See Hart & Hegeman Mfg. Co.
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P. & S. See Pass & Seymour, Inc.
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Royal. See Sears, Henry D.
Scovill Mfg. Co., Waterbury, Conn. (Acorn.)
Sears, Henry D., 50 Boylston, Boston, Mass.
Weber. See Sears, Henry D.
Wittenberg Bros., 60 Shipman, Newark, N. J. Links, Insr-

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Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Can-del-lite. See Sears, Henry D.
Eagle Electric Mfg. Co., 59 Hall, New York, N. Y.
Electric Co., 94 Allyn, Hartford, Conn.
General Electric Co., Merchandise Dept., Section W-232, Bridgeport, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Pass & Seymour, Solvay Sts., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York, N. Y.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sears, Henry D., 50 Boylston, Boston, Mass.
SOCKETS, Radio. See Radio Receiver Parts.

SOCKETS AND RECEPTACLES, Lamp

Bases other than Standard (or Medium) are indicated as follows: Mogul, M; Candelabra (or Miniature), C.

Key	See K
Composition	See W
Metal Shell	See B
Porcelain	See A
Pull Chain	See P
Push Through	See T
Sign Receptacles	See A

A. B. C. See Leviton Mfg. Co.
Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... A
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo. ..... W
Alabax. See Arrow Elec. Co.
Appleton Electric Co., 1730 Wellington Ave., Chicago, Ill. ..... A
Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa. ..... A
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. M C K T P B A
Arrogrip. See Arrow Elec. Co.
A. & W. See General Outdoor Adv. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. ..... C . . . . P B .

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Best. See United States Elec. Mfg. Corp.
Bryant Elec. Co., Bridgeport ..... M C K T P B A
C-H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. ..... M . . K T P B A
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. .....
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... M . . K T . . B A
Crouse-Hinds Co., Syracuse, N. Y. .. A W .....
Cutler-Hammer, Inc., 1287 St. Paul Ave., Milwaukee, Wis. ..... K T . . B A
Durex. See Wheeler Reflector Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. .....
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... P B . .
Far-Go Elec. Mfg. Co., 368 Broome, New York, N. Y. ..... C .....
Federal Electric Co., 6700 S. State, Chicago, Ill. ..... A
Flute. See Pass & Seymour.
Fiuteller. See Pass & Seymour.
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. ..... M C . . . . B . .
Gaynor Elec. Co., Bridgeport, Conn. ..... A
General Elec. Co., Section W-232, Merchandise Dept., Bridgeport, Conn. .. M C K T P B A
Glow Elec. Co., 22 Queens, Long Island City, N. Y. ..... M . . . . . B . .
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... M C K T P B A
Hoosick Falls Radio & Elec'l Parts Mfg. Co., Hoosick Falls, N. Y. .... W .....
Hubbell, Inc., Harvey, Bridgeport, Conn. M C K T P B A
H. & H. See Hart & Hegeman.
I-D-A. See Watson Mfg. Co., J. E.
K-E Cleat Receptacle. See Kirkman.
Kirkman Engineering Co., 1 Dominick, New York. (Cleat Receptacle.) .....
Leader. See Leviton Mfg. Co.
Leiser & Co., W. A., 1607 Sansom, Philadelphia, Pa. ..... A
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y. ..... M C K . . P B A
Levolier. See McGill Mfg. Co.
Liberty Bell. See Hart & Hegeman.
Locat-A-Catch. See Connecticut.
McGill Mfg. Co., Valparaiso, Ind. ..... P B A
Majestic Elec. Mfg. Co., 806 N. 12th, St. Louis. (Lamp Receptacle.) ..... A
Meteor Elec. Corp., 499 E. 70th, New York, N. Y. ..... K . . P . . .
Molded Socket Corp., Railroad, Pa. .... K .....
Multi Elec'l Mfg. Co., 1840 W. 14th, Chicago, Ill. ..... A
Multilok. See Circle F Mfg. Co.
Newgard. See Multi Elec'l Mfg. Co.
New Wrinkle. See Bryant Elec.
Noark. See Colt's Patent Fire Arms.
One 4 All. See Propp Co., M.
P. & S. See Pass & Seymour.
Pass & Seymour, Solvay Station, Syracuse, N. Y. ..... M C K T P B A
Paulding, John L., New Bedford, Mass. ..... B A
Perkins. See Bryant Elec. Co.
Porcelain Products, Inc., Findlay, O. ..... A
Propp Co., M., 524 Broadway, New York, N. Y. .....
Quick Catch. See Hubbell, Inc.
Royal. See Sears, Henry D.
Safti Soc. See Molded Socket Corp.
Sears, Henry D., 50 Boylston, Boston M C K T P B A
Security. See Circle F Mfg. Co.
Shurlock. See Pass & Seymour.
Siemen Co., Bridgeport, Conn. .....
Taplet Mfg. Co., 3709 Powelton Ave., Philadelphia, Pa. ..... A
TEC. See Electric Company.
Titan. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. ..... A
Union Insul. Co., Parkersburg, W. Va. ..... A
United States Elec. Mfg. Corp., 222 W. 14th, New York, N. Y. ..... P . . B . . W
U. S. Electric Co., 311 Chambers St., Trenton, N. J. ..... A
Waleo. See Leiser & Co., W. A.
Waterbury Button Co., Waterbury, Conn. .....
Watson Mfg. Co., J. E., 5506 N. Fifth, Philadelphia, Pa. (Concealed Fixture) ..... P B . .
Weber. See Sears, Henry D.
Wheeler Reflector Co., 275 Congress St., Boston, Mass. ..... P . . .
Wiring Devices, Inc., 5 High, Trenton, N. J. ..... A
Wood Electric Co., C. D., 565 Broadway, New York. (Sign Receptacles.) ..... A
Woodwin. See Wood Elec. Co.
Wrinklet. See Bryant Elec. Co.

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Aluminum Solder Corp. of America, 730 Fifth Ave., New York, N. Y.
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Solderlume. See Aluminum Solder Corp. of America.
Union Smelting & Refining Co., Newark, N. J.
Usarco. See Union Smelting & Refining Co.

SOLDER, Bar and Wire

Eagle. See Hoyt Metal Co.
Genuine A. See Hoyt Metal Co.
Hoyt Metal Co., St. Louis, Mo.

SOLDER, Self-Fluxing

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Chicago Solder Co., 4210 Wrightwood Ave., Chicago, Ill.
Dutch-Boy. See National Lead Co.
Gardiner Metal Co., 1366 W. Lake, Chicago, Ill.
Kester. See Chicago Solder Co.
Lenk Mfg. Co., 32 Merrimac, Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Tinol. See American Solder & Flux Co.

SOLDER, Silver

Handy & Harman, 57 William, New York, N. Y.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.
SOLENOIDS. See Coils, Finished.

SOLDERING

Compounds. See Soldering Compounds.
Irons. See Soldering Irons.
Machines. See Soldering Machines, Commutator
Tools. See Torches and Furnaces.

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Ameo. See American Solder & Flux Co.
Anchor. See Garden City Laboratory.
Benson Co., Alex R., Hudson, N. Y. (Salts and Paste.)
Burnley Battery & Mfg. Co., North East, Pa. Paste and Stick.
Brunner Chemical Wks., 217 E. 3rd, Cincinnati, O.
Callahan & Co., Geo., 218 Front, New York. (Fluid.)
Central Stamping Co., 206 Broadway, New York, N. Y. Paste and Salts.
Challenge. See Highland Electro Chemical Co.
Conductalute. See Technical Products Co.
Crescent. See McGill Mfg. Co.
Diamond. See Burnley Battery & Mfg. Co.
Dielectric Mfg. Co., St. Louis, Mo.
Dunton Co., M. W., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Eureka. See Grasselli Chemical Co.
Firth Radio Corp., 25 Beaver, New York, N. Y.
Fluxite. See Monarch Products Co.
Garden City Laboratory, 300 W. Adams, Chicago, Ill.
General Elec. Co., Section W-231, Merchandise Dept., Bridgeport, Conn. (Paste).
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Highland Electro Chemical Mfg. Co., Connellsville, Pa. (Paste, Stick, Salts.)
Incomparable. See Reade Mfg. Co.
Leveridge, Inc., Chas. W., 246 Fulton, New York, N. Y.
Luco. See Lukens Metal Co.
Lukens Metal Co., T. F., 1105 Fairmount Ave., Philadelphia, Pa.
McGill Mfg. Co., Valparaiso, Ind. Fluid.
Mitchell-Rand Mfg. Co., 19 Vesey, New York. (Paste.)
Monarch Products Co., Red Bank, N. J.
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New-Idea. See Hartwig Co., Wm. J.
Nokorode. See Dunton Co., M. W.
Oakwood. See Weaver Specialty Co.
Paragon Insulating Co., 5716 Euclid Ave., Cleveland, O.
Perfecto. See Firth Radio Corp.
Pfanstiehl Chemical Co., Waukegan, Ill. Paste, Salts, Sticks, Fluid, Oil, and Solid Sal Ammoniac.
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Redens. See Reade Mfg. Co.
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Rotax Mfg. Co., 380 E. 133rd, New York, N. Y
Ruby Chemical Co., Columbus, O.
Ruby Fluid. See Ruby Chemical Co
Salbrick. See American Solder & Flux Co.
Silva-Wares, Inc., 134 W. 26th, New York, N. Y.
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. (Paste.)
Snowflake. See Grasselli Chemical Co.
Snowflake. See Highland Electro Chemical Co.
Solderine. See Central Stamping Co.
Solderite, Inc., 22 Green, Newark, N. J.
Speco. See Pfanstiehl Chemical Co.
Standard. See Grasselli Chemical Co.
Star. See McGill Mfg. Co
Superior. See Highland Electro Chemical Co.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh Pa. (Paste).
Tinol. See American Solder & Flux Co.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago, Ill.
Weaver Specialty Co., 6344 Aurelia, Pittsburgh, Pa
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Beckwith Machine Co., Ravenna, Ohio.
Betsy Ross. See Central Flatiron Mfg. Co.
Brach Mfg. Corp., L. S., Newark, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
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Electric Soldering Iron Co., Inc., 135 W. 17th, New York.
Electrical Products Mfg. Co., Providence, R. I.
Enco. See Electrical Necessities Corp.
Esico. See Electric Soldering Iron Co.
Everhot. See Swartzbaugh Mfg. Co.
Ever-Ready. See Gold Seal Elec. Co.
General Electric Co., Schenectady, N. Y.
Gold Seal Elec. Co., 250 Park Ave., New York, N. Y.
Home. See Majestic Elec. Appliance Co.
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Industrial. See Permway Mfg. Co.
Jiffy. See Koch & Co., Paul W.
Junior. See Drake Elec. Wks.
King. See Electric Heat Control Co.
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Lotan. See Simplex Flux & Solder Co. of America.
Lucifer. See Jones Point Tool & Elec. Co.
Majestic Electric Appliance Co., San Francisco, Cal.
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Samson Cutlery Co., 8 Jones St., Rochester, N. Y.
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Silver King. See Illinois Stamping & Mfg. Co.
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Torrid. See Beardsley & Wolcott Mfg. Co.
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SOLENOIDS. See Coils
SOLVENTS & REDUCERS, VARNISH. See Paint, Varnish, Lacquer.
SPAGHETTI. See Tubing, Varnished Fabric.
SPEED CHANGING UNITS. See Gears (Speed Changing Units).
SPEED INDICATORS. See Tachometers.
SPOOLING MACHINES, WIRE. See Wire Manufacturing Machines.

SPRAYING OUTFITS

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Babco. See Simons Paint Spray Brush Co.
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De Vilbiss Mfg. Co., 3750 Detroit Ave., Toledo, Ohio.
Eclipse Air Brush Co., 79 Orange, Newark, N. J.
Electric Sprayit Co., 320 E. Colfax Ave., South Bend, Ind.
Eureka Pneumatic Spray Co., 87 130th, Richmond Hill, N. Y.
Eureka Sprayers, Inc., 87-28 130th, Long Island City, N. Y.
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Kellogg Mfg. Co., 97 Humboldt, Rochester, N. Y.
Koch Bros. Mfg. Co., 2339 Nelson, Chicago, Ill.
K B. See Koch Bros. Mfg. Co.
Metal Specialties Mfg. Co., 338 N. Kedzie Ave., Chicago.
Macleod Co., 2232 Bogen, Cincinnati, O.
Paasche Air Brush Co., 1911 Diversey Parkway, Chicago, Ill.
Pioneer Air Compressor Co., 176 Grand, New York, N. Y.
Presto. See Metal Specialties Mfg. Co.
Simons Paint Spray Brush Co., 17 Maryland Ave., Dayton, O.
Simplex Spray Equipment Co., 552 W. Lake, Chicago, Ill.
Sprayit. See Electric Sprayit Co.
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Cleveland Wire Spring Co., Cleveland, O.
Cook Spring Co., Ann Arbor, Mich.
Cuyahoga Spring Co., Berea Rd., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Gibson Co., Wm. D., 1800 Clybourn Ave., Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Lee Spring Co., 34 Main, Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge, Brooklyn, N. Y.
Newcomb Spring Corp., 234 40th, Brooklyn, N. Y.
Peck Spring Co., Plainville, Conn.
Peterson Spring Co., 1660 Beard Ave., Detroit, Mich.
Rapid Spring Co., 222 Second Ave., Pittsburgh, Pa.
Raymond Spring Co., Corry, Pa.
Standard Spring and Manufacturing Co., 238-42nd St., Brooklyn, N. Y.
Steinen & Co., 297 Washington, Newark, N. J.
Wallace Barnes Co., Bristol, Conn.
Young Industries, Inc., L. A., Detroit, Mich.

STAMPED BOXES. See Cabinets, Sheet Steel.
STAMPINGS, Fibre. See Fibre.
Sheet Metal. See Fixture Fittings.
Sheet Steel. See Stampings, Sheet Steel.
Small. See Stampings, Small.

STAMPINGS, Sheet Steel

Heavy Stamping and Drawing.
Acklin Stamping Co., 1925 Nebraska, Toledo, O.
American Stamping Co., 978 E. 64th, Cleveland, O.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bossert Corp., Utica, N. Y.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Hubbard & Co., Pittsburgh, Pa.
Janney, Steinmetz & Co., 1421 Chestnut St., Philadelphia.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn.
Mullins Mfg. Corp., Washing Machine Division, Salem, Ohio. (Vitreous Enameled)
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
Truscon Steel Co., Youngstown, O.

STAMPINGS, Small

Small Stamped Metal Parts for Electrical Devices.
Advance Tool & Die Casting Co., 1654 Holton, Milwaukee.
Aerial Machine & Tool Co., 79 Grand, New York, N. Y.
American Emblem Co., Utica, N. Y.
American Radio Hardware Co., 135 Grand, New York, N. Y.
American Stamping Co., 978 E. 64th, Cleveland, O.
Arrow Automatic Products Corp., 27 Vestry, New York, N. Y.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Bull Dog Electric Products Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
Clarke Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros. Co., Plano, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Kelly Brass Wks., 226 W. Ontario, Chicago, Ill.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Lansing Stamping Co., Lansing, Mich.
Lenz Metal Stamping Wks., J., 199 Franklin, New York.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Mutual. See Bull Dog Elec. Products Co.
Patton-MacGuyer Co., Providence, R. I.
Paul & Beekman Mfg. Co., 1734 N. Fifth, Philadelphia, Pa.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Premax Products, Inc., Niagara Falls, N. Y.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Reliance Die & Stamping Co., 501 N. La Salle, Chicago.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Signal Elec. Mfg. Co., 1904 Broadway, Menominee, Mich.
Steinen & Co., 297 Washington, Newark, N. J.
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
United Stamping & Mfg. Co., Cleveland, Ohio.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Waterbury Metal Wares Co., Waterbury, Conn.
Zierick Machine Wks., F. B., 68 E. 131st St., New York, N. Y.

STANDS, Armature

Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17 & Cambria Sts., Philadelphia, Pa.
Oman, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

STARTERS, Motor. See Controllers, Motor; Switches, Remote Control; Switches, Knife; Safety; Switches, Snap (Heavy Duty).
STEATITE. See Cores, Resistance Coil.
STEEL CASTINGS. See Castings, Steel.

STEEL for Electric Appliances

Elyria Iron & Steel Co., Elyria, O.
Ryerson & Son, Jos., 2558 W. 16th, Chicago, Ill.

STEEL, Magnet

Ajax Electrothermic Corp., Trenton, N. J.
Hercules Elec. Steel Corp., 145 Lafayette St., New York.
Indiana Steel Products Co., 4545 S. Western Ave., Chicago.
Ludlum Steel Co., Watervliet, N. Y.

STEEL SHEETS

Agathon. See Central Alloy Steel Corp.
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middleton, Ohio.
American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh.
Armelec. See Empire Steel Corp.
Central Alloy Steel Corp., Massillon, O.
Cyclops Steel Co., Titusville, Pa.
Dynelec. See Empire Steel Corp.
Empire Steel Corp., Mansfield, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Manelec. See Empire Steel Corp.
Metelec. See Empire Steel Corp.
Newport Rolling Mill Co., Newport, Ky.
Polelec. See Empire Steel Corp.
Republic Iron & Steel Co., 335 Market, Youngstown, O.
Tranelec. See Empire Steel Corp.
Uniloy. See Universal Steel Co.
Universal Steel Co., Bridgeville, Pa.
Wheeling Steel Corp., Wheeling, W. Va.

STEEL, STRIP. See Strip Steel.

STOCKS, Dies and Reamers

Hall-Will, Inc., Erie, Pa.
Red-E-Hall. See Hall-Will, Inc.
Toledo Pipe Threading Machine Co., 1445 Summit, Toledo, O.

STONES, Commutator

Acme. See Green Equipment Corp.
Caro. See Electric Service Supplies Co.
Cleveland Stone Co., Union Trust Bldg., Cleveland, O.
Co-operative Utilities Co., 15th & Columbia Ave., Philadelphia, Pa.
Diamond Dee. See Co-operative Utilities Co.
Electric Service Supplies Co., 17th and Cambria, Philadelphia, Pa.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Lombard & Co., Somerville, Mass.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.

STOOLS, Factory; Steel

Angle Steel Stool Co., Plainwell, Mich.
Royal Metal Mfg. Co., 1136 South Michigan Ave., Chicago, Ill.

STORAGE
Battery Plates. See Plates, Storage Battery.
Battery, Separators. See Separaters.
Tools. See Tools, Storage Battery.

STRAINING MACHINES, INSULATION. See Wire Manufacturing Machines.

STRAIGHTENERS, Armature Shaft

Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

STRANDING MACHINES. See Wire Manufacturing Machines.

STRIP STEEl

(Hot and Cold Roll).
Acme Steel Co., 2840 Archer Ave., Chicago, Ill. (Hot & Cold).
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. (Cold).
American Tube & Stamping Plant (Stanley Wks.) Bridgeport, Conn. (Hot & Cold.)
Athenia Steel Co., 135 William, New York, N. Y. (Cold.)
Barnes Co., Wallace, Bristol, Conn. (Hot.)
Central Alloy Steel Corp., Massillon, O. (Hot.)
Griffin Mfg. Co., Erie, Pa. (Hot & Cold.)
Laclede Steel Co., 8th & Olive Sts., St. Louis, Mo. (Hot.)
Latrobe Electric Steel Co., Latrobe, Pa. (Hot & Cold.)
Republic Iron & Steel Co., 335 Market, Youngstown, O.
Sharon Steel Hoop Co., Sharon, Pa. (Hot.)
Stanley Wks., New Britain, Conn. (Hot & Cold.)
Steel and Tubes, Inc., Cleveland, O. (Hot & Cold.)
Superior Steel Corp., Union Trust Bldg., Pittsburgh, Pa. (Hot & Cold.)
West Leechburg Steel Co., Farmers Bank Bldg., Pittsburgh, Pa. (Hot & Cold.)

STRIPPERS, Wire

Acme. See A. Laubscher.
Arter Engineering Co., 69 Wisconsin, Milwaukee, Wis. (Cutting, Stripping and Measuring).
Austin Co., M. B., 108 S. Desplaines, Chicago, Ill.
Dicke Tool Co., Downers Grove, Ill.
E-Z. See Pyramid Products Co.
F. F. See France Mfg. Co.
Foley Saw Tool Co., 655 Foley Bldg., 9 Main, N. E., Minneapolis, Minn. (Bench Type Wire Stripper.)
France Mfg. Co., 10325 Berea Rd., Cleveland. (Motor Driven.
Goehst. See Klein & Sons.
Hartman. See Service Sales & Mfg. Co.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill
Ives Mfg. Co., Meriden, Conn.
Klein & Sons, Mathias, Chicago, Ill.
Laubscher, A., 77 Fort Pleasant Ave., Springfield, Mass.
Service Sales & Mfg. Co., 17505 Melgrave Ave., Cleveland, Ohio.
Speedcraft. See Wire Stripper Co.
Wire Stripper Co., 508 Erie Bldg., Cleveland, O.
Zierick Machine Wks., F. B., 6 Howard, New York City. (Motor Driven Stripper & Twister).

SWITCHBOARD INSTRUMENTS. See Instruments, Portable and Switchboard.
SWITCHBOARD OPALS. See Lenses.
SWITCHBOARDS, SLABS AND BARRIERS
See Asbestos Slabs; Molded Insulation: Slate; Soapstone.

SWITCH (Switches)

Arms. See Posts, Binding.
"Across the Line" Type. See Controllers, Motor.
Baby Knife. See Switches, Battery.
Battery. See Switches, Battery.
Canopy. See Switches, Snap.
Clock Operated. See Switches, Time.
Feed Through. See Switches, Snap.
Fixture. See Switches, Snap.
Float. See Switches, Tank.
Flush. See Switches, Snap.
Handles. See Handles, Wood
Knife, Baby. See Switches, Battery & Baby Knife.
Lever Radio. See Radio Mounting.
Lever. See Switches, Snap, Lever.
Limit. See Controllers, Motor.
Mercury. See Switches, Mercury
Motor Starting. Magnetic Type. See Controllers.
Motor Starting. Non-Magnetic. See Switches, Motor Starting.
Pendant. See Switches, Snap.
Pressure Regulating. See Controllers.
Push Button, Snap. See Switches, Snap.
Push Button, Motor Starting. See Switches, Remote Control.
Radio Receiver. See Radio Mountings.
Range. See Switches Snap; Heavy Duty
Remote Control. See Switches, Remote Control.
Reversing. See Controllers
Rotary. See Switches, Snap.
Safety. See Switches, Knife.
Snap. See Switches, Snap.
Starter Type. See Controllers.
Storage Battery. See Switches, Storage Battery.
Surface. See Switches, Snap.
Tank. See Switches, Tank
Time. See Switches, Time.
Toggle. See Switches, Snap.
Tumbler. See Switches, Snap.

SWITCHES, Battery and Baby Knife

Cut-Out Switches.
Anti-Wood. See Kell & Son, Francis.
Bridgeport Switch Co., 209 Center, Bridgeport, Conn.
Bryant Electric Co., Bridgeport, Conn.
Chapman. See Frank W. Morse & Co.
Chicago Elec. Mfg. Co., 2801 S. Halsted, Chicago, Ill.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Crown. See Edwards & Co., Inc.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Edwards & Co., Inc., 140th & Exterior, New York, N. Y.
Electrad, Inc., 428 Broadway, New York, N. Y.
Eureka. See Frank W. Morse & Co.
Fahnestock Elec. Co., cor. East Ave. and 8th, Long Island City, N. Y.
Handy. See Chicago Elec. Mfg. Co.
H. & H. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (Push Button.)
Harwood. See Frank W. Morse & Co.
Heinemann Elec. Co., Philadelphia, Pa.
Jost. See Frank W. Morse & Co.
Kapna. See Trumbull Elec. Mfg. Co.
Kell & Son, Francis, 401 E. 163rd, New York, N. Y.
Kendrick & Davis Co., Lebanon, N. H.
Keystone. See Frank W. Morse & Co.
King Mfg. Co., B. C., 302 Park Ave., Brooklyn, N. Y.
Knox Porcelain Corp., Knoxville, Tenn.
K-P-F Elec. Co., 855 Howard St., San Francisco, Cal.
Kurz & Root, Appleton, Wis.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Lyons Mfg. Co. (Mt. Carmel), New Haven, Conn.
Majestic Elec. Mfg. Co., 80 N. 12th St., St. Louis, Mo.
Manhattan Elec'l Supply Co., 17 Park Pl., New York, N. Y.
Morse Co., Frank W., Boston, Mass.
Partrick & Wilkins Co., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, Ohio.
Powerlite Switchboard Mfg. Co., 4149 E. 79th, Cleveland, O.
Pullrite. See Frank W. Morse & Co.
Reliable Electric Co., 3145 Carroll Ave., Chicago, Ill.
Samson Electric Co., Canton, Mass.
Spero Elec. Mfg. Co., E. 33rd and Woodland Ave., Cleveland
Sta-Rite. See Frank W. Morse & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Wood Elec. Co., C. D., 565 Broadway, New York, N. Y.

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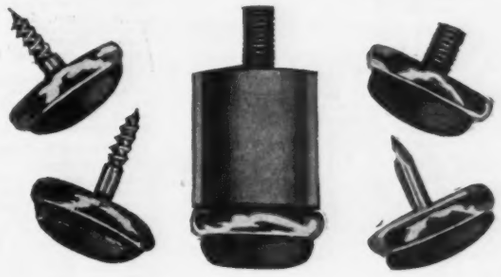

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AMERICAN INSULATOR CORP.
New Freedom, Pa.

SWITCHES, Mercury
(For Temperature Control Apparatus.)
Con-Tac-Tor. See Time-O-Stat Controls Co.
Cooper Hewitt Electric Co., 410 Eighth, Hoboken, N. J.
Crambiet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
General Kontroler Co., 200 E. First, Dayton, O.
Kon-nec-tor. See Cooper Hewitt Elec. Co.
Kontax. See General Kontroler Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Time-O-Stat Controls Co., Elkhart, Ind.

SWITCHES, Motor Starting
Accesible. See Trumbull-Vanderpoel Elec. Mfg. Co.
Aces. See Colt's Patent Fire Arms Mfg. Co.
Adam Elec. Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Barber Elec. Mfg. Co., North Attleboro, Mass.
Bull Dog Electric Products Co., Detroit, Mich.
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Crouse-Hinds Co., Syracuse, N. Y.
E. W. See Trumbull Elec. Mfg. Co.
FA. See Adam Elec. Co., Frank.
F. A. Triumph. See Metropolitan Elec. Mfg. Co.
Federal Steel Products Co., 2 Ave. L., Newark, N. J.
Large-Dail Mfg. Co., 606 Cherry, Philadelphia, Pa.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O
Lundy Co., E. A., Fulton Bldg., Pittsburgh.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Major. See Adam Elec. Co., Frank.
Mason. See Trumbull-Vanderpoel Elec. Mfg. Co.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
Metropolitan Elec. Mfg. Co., Blvd. at 14th, Long Island City, N. Y.
Murray. See Metropolitan Device Corp.
Mutual. See Bull Dog Elec. Products Co.
Naro. See Metropolitan Elec. Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Nublade. See Colt's Patent Fire Arms Mfg. Co.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Robbins & Myers, Inc., Springfield, O.
Safe-Lock. See Trumbull-Vanderpoel Elec. Mfg. Co.
Safelock. See Westinghouse Elec. & Mfg. Co.
Schmuckler & Sons, 2232 N. 28th, Philadelphia, Pa.
Square D Co., Detroit, Mich.
S. S. See Wadsworth Elec. Mfg. Co.
Tanner & Co., Wm. F., 511 Sharp, Baltimore, Md.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
T. V. Safelock. See Trumbull-Vanderpoel Elec.
Unisafti. See Metropolitan Device Corp.
Unit-Versal. See Bull Dog Elec. Products Co.
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegmann & Co., E. M., 3611 N. 11th, St. Louis.

SWITCHES, Remote Control
Push Button, Magnetically Operated.
Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Cutler-Hammer, Inc., 1287 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Section W-232, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
H. P. See Palmer Elec. & Mfg. Co.
Industrial Controller Co., Milwaukee, Wis.
Kato Engr. Co., Mankato, Minn.
Major, F. A., System. See Adam Elec. Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Precise Mfg. Co., 254 Mill, Rochester, N. Y.
Protectoswitch. See Precise Mfg. Co.
R. C. O. C. See South Bend Current Controller Co.
Sauter. See Cramer & Co., R. W.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
South Bend Current Controller Co., South Bend, Ind.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Takamine Corp., 208 Rawson St., Long Island City, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore.
Triplock. See Monitor Controller Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

SWITCHES, Snap

	KEY
Feed Through	See p
Fixture (Canopy, Candelabra and Key Arm)	See F
Flush	See f
Lever, Toggle, Tumbler	See L
Pendant	See p
Push Button	See P
Rotary	See R
Surface	See s

See Also Switches, Snap; Heavy Duty.
Adam Electric Co., Frank, St. Louis, Mo. f
Anylite Elec. Co., Ft. Wayne, Ind. L
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. f sp P R L F
Arrow Head. See Arrow Elec.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. f p P F
Best. See United States Elec. Mfg. Corp.
Bracelite. See Guth & Co., Edwin.
Bremer Elec. Mfg. Co., 139 N. 7th, Philadelphia, Pa. f
Bridgeport Switch Co., 209 Center, Bridgeport, Conn. L F
Bryant Elec. Co., Bridgeport, Conn. f sp P R L F
B. S. Co. See Bridgeport Switch Co.
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn. F
Circle F. Mfg. Co., Trenton, N. J. f P L F
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. p P R L F
Crouse-Hinds Co., Syracuse, N. Y. L
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis. P L
Diamond H. See Hart Mfg. Co.
Dugle. See Bryant Elec. Co.
Economy Fuse Mfg. Co., 2717 Greenview Ave., Chicago, Ill. F
Gaynor Elec. Co., Bridgeport, Conn. f L
General Elec. Co., Section W-232, Merchandise Dept., Bridgeport, Conn. f sp P R L F
Glo-Guide. See Bryant Elec. Co.

Gold Star Push Switch. See Hart & Hegeman.
Guth & Co., Edwin, 2615 Washington Ave., St. Louis, Mo. F
Hart Mfg. Co., Hartford, Conn. f sp P R L
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co. (Door Bolt Control) f sp P R L F
Hart. See Hart & Hegeman.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Inc., Harvey, Bridgeport, Conn. sp L F
Jost. See Morse, Frank W.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y. f P
Leviton Mfg. Co., 226 Newell, Brooklyn F
Levoller. See McGill Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. f L F
Marks Products Co., 80 N. Ninth, Brooklyn, N. Y. L F
Metropolitan Elec. Mfg. Co., Blvd. at 14th St., Long Island City, N. Y. s R
Morse Co., Frank W., 291 Congress, Boston P
National. See Standard Elec. Mfg. Co.
New England. See Paulding, John L.
Nutmeg. See Hubbell, Harvey, Inc.
Operite. See Morse Co., Frank W.
Pass & Seymour, Solvay Sts., Syracuse, N. Y. f sp P L F
Paulding, John I, New Bedford, Mass. f s P
Pen Tap. See Beaver Mfg. Co.
Perkins. See Bryant Elec. Co.
Pilot Electric Mfg. Co., 323 Berry, Brooklyn, N. Y. L
Pilotoggle. See Pilot Elec. Mfg. Co.
Pullrite. See Morse, Frank W.
Rodale Mfg. Co., 200 Hudson, New York p
Sears, Henry D., 80 Boylston, Boston f sp P R L F
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa. P
Snapit. See Marks Products Co.
Spartan. See Bryant Elec. Co.
Standard Elec. Mfg. Co., 941 Wrightwood Ave., Chicago, Ill. f s P R L
Trigle. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. f s P R L
Tumbolier. See Hart & Hegeman.
Twi-Lite. See McGill Mfg. Co.
United States Elec. Mfg. Corp., 222 W. 114th, New York, N. Y. f
Victor. See Kell & Son, Francis.
Weber. See Sears, Henry D.
Workrite. See Morse, Frank W.
Yankee. See Bryant Elec. Co.

SWITCHES, Snap; Heavy Duty
Heavy duty rotary snap switches for Electric Range and Small Motor Control.
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
Diamond H. See Hart Mfg. Co.
Domestic Electric Co., 7723 St. Clair Ave., Cleveland, Ohio.
General Electric Co., Section W-232, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.

SWITCHES, Storage Battery; Automatic Disconnecting
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Penn Electric Machine Co., Des Moines, Ia.
Radioloc. See Cutler-Hammer Mfg. Co.

SWITCHES, Tank
Automatic Appliance Co., 126 N. St. Clair, Dayton, Ohio.
Blackburn-Smith Corp., 25 W. 45th, New York, N. Y.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Electrical Repair Co., 240 W. 25th, New York, N. Y.
General Electric Co., Schenectady, N. Y.
Industrial Controller Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Leader-Trahern Products Co., Decatur, Ill.
Ostrander Elec. Wks., W. B., 911 Atlantic Ave., Brooklyn.
Penn Elec. Switch Co., 20th & Walnut, Des Moines, Ia.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, Time (Automatic Clock Operated Switches)
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Astrachron. See Gem Engineering Co.
Automatic Elec. Heater Co., 1505 Race, Philadelphia, Pa.
Automatic Elec. Mfg. Co., Mankato, Minn.
Automatic Lighting Co., 831 Greenmount Ave., Baltimore.
Automatic Sprinkler Corp. of America, 910 B. of L. E. Bank Bldg., Cleveland, Ohio.
Automatic Timer Co., 1841 Euclid Ave., Cleveland, O.
Berry, A. Hall, 73 Murray, New York, N. Y.
Brown & Pengilly, Inc., 1264 Folsom, San Francisco, Cal.
Cackle. See Berry A. Hall.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Clark. See Automatic Heater Co.
Cleveland. See D. J. Time Switch Co.
Con-tac-tor. See Absolute Con-tac-tor Corp.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
D-J Time Switch Co., 1306 E. 14th, Cleveland, O.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Frisch, Walter P., 104 Linden, Rochester, N. Y.
Gem Engineering Co., Hempstead, N. Y.
General Electric Co., Schenectady, N. Y.
Go-N-Set. See G. & S. Research Lab.
G. & S. Research Laboratory, 1269 Cochran Ave., Los Angeles, Cal.
Hart Mfg. Co., Hartford, Conn.
Hartford. See Berry A. Hall.
Horni Signal Mfg. Co., 290 Hudson, New York, N. Y.
Knowles, W. E., 2869 Broadway, Oakland, Cal.
Kwixset. See Thompson Clock Co.
Lamp-Lighter. See Robbins & Myers Co.
Liberty Bell Mfg. Co., Minerva, Ohio.
Mercury Time Switch Co., Marine City, Mich.
Northwestern Clock Co., Omaha, Neb.
Ohio Time Switch Co., 1439 St. Clair Ave., Cleveland.
Paragon Elec. Co., 409 S. Dearborn, Chicago, Ill.
Racine. See Reliance Automatic Ltg. Co.
Radio Owl, 2269 E. 51st, Los Angeles, Cal.
Reliance Automatic Ltg. Co, 1925 Meade, Racine, Wis.
Research Mfg. Laboratory, 1269 Cochran Ave., Los Angeles.
Robbins & Myers Co., Springfield, O.
Ross Safety Switch Corp., 1 E. 42nd, New York, N. Y.
Sauter. See Cramer & Co.
States Co., Hartford, Conn.
Thompson Clock Co., H. C., Bristol, Conn.
York Clocks, Inc., 12 E. 41st, New York, N. Y.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

TACHOMETERS
Speed Indicators, Speedometers, Revolution Counters.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Durant Mfg. Co., 655 Buffum, Milwaukee, Wis.

Electric Tachometer Corp., Spring Garden & Broad St., Philadelphia, Pa.
Holtzer-Cabot Elec. Co., Boston, Mass.
Leeds & Northrup Co., 4901 Stenten Ave., Philadelphia, Pa.
Productimeter. See Durant Mfg. Co.
Standco. See Sticht & Co.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Veeder Mfg. Co., 14 Sargeant, Hartford, Conn.
Weston Elecl. Instrument Co., 582 Frelinghuysen Ave., Newark, N. J.
Zernickow Co., O., 15 Park Row, New York, N. Y.

TAGS, Cable; Pole and Battery
American Radio Hardware Co., 135 Grand, New York, N. Y.
(Battery Lead Tags.)
Benedict Mfg. Co., East Syracuse, N. Y.
Brooklin Underground Elec'l Mfg. Co., Glenside, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Grimmes & Sons, Inc., L. F., Allentown, Pa.
International Tag Co., 319 N. Whipple, Chicago, Ill.
Premax Products, Inc., Niagara Falls, N. Y.
Viking Tool & Machine Co., 745 65th, Brooklyn, N. Y.
Waterbury Button Co., Waterbury, Conn.

TAGS, Shipping
Campbell Paper Box Co., South Bend, Ind.
International Tag Co., 319 W. Whipple, Chicago, Ill.
TANK SWITCHES. See Switches, Tank.
TANKS, TINNING. See Wire Manufacturing Machines.

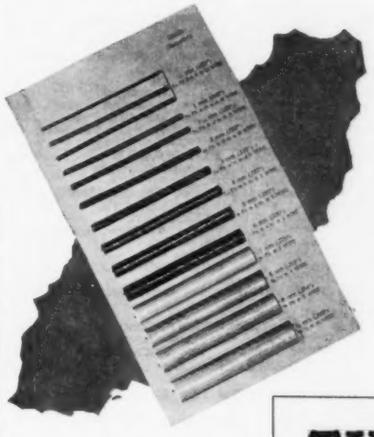
TAPE, Asbestos
American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
General Asbestos & Rubber Co., Charleston, S. C.
Johns-Manville Corp., New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Niagrite. See Johns-Manville, Inc.
Shield Brand. See Mitchell-Rand Mfg. Co.

TAPE, Cotton, Linen, Silk; Tape, Sleeving, Webbing.
Anchor Webbing Co., Nye, Pawtucket, R. I. (Cotton, Silk.)
Awabco. See Anchor Webbing Co.
Eagle. See Sidebotham, Inc., John.
General Electric Co., Schenectady, N. Y.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.
Hope Webbing Co., 1005 Main, Providence, R. I.
Krout & Fite Mfg. Co., Allegheny Ave. & Emerald, Philadelphia, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sidebotham, Inc., John, 4317 Griscom, Philadelphia, Pa.
Smith Belting Co. (Germantown), Philadelphia, Pa.
Superfine. See Windsor Webbing Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Windsor Webbing Co., Pawtucket, R. I.
Worcester Braiding Co., 34 Southbridge, Worcester, Mass.

TAPE, Mica
Chicago Mica Co., 345 Campbell, Valparaiso, Ind.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Rubber and Friction
Ackerman. See Ackurate Rubber Co.
Ackurate Rubber Co., 25 Beaver St., New York, N. Y.
Adamson & Co., Joseph, Columbia and Germantown Aves., Philadelphia, Pa.
Adhere. See Westinghouse Elec. & Mfg. Co.
Alpha. See Johns-Manville, Inc.
Amazon. See Graybar Elec. Co.
Appleton Rubber Co., Franklin, Mass.
Black Diamond. See Dunton Co., M. W.
Boston Woven Hose & Rubber Co., Boston, Mass.
Brooklyn. See Johns-Manville, Inc.
Bull-Dog. See Boston Woven Hose & Rubber Co.
Candee. See Ackurate Rubber Co.
Canfield Rubber Co., Bridgeport, Conn.
Canton. See Plymouth Rubber Co.
Clifton. See Clifton Mfg. Co.
Clifton Mfg. Co., 65 Brookside Ave., Boston 30, Mass.
Competition. See New York Insulated Wire Co.
Double-Wear. See Dryden Rubber Co.
Dryden Rubber Co., 1014 S. Kildare Ave., Chicago, Ill.
Dundee, A. & B. See Okonite Co.
Dunton Co., M. W., 670 Eddy St., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Elkhart Rubber Wks., Elkhart, Ind.
Firestone Tire & Rubber Co., Akron, O.
General Electric Co., Section W-232, Merchandise Dept., Bridgeport, Conn.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y.
Grimshaw. See New York Insulated Wire Co.
Griptite. See Canfield Rubber Co.
Holdfast Rubber Co., Atlanta, Ga.
Holdtite. See United States Rubber Co.
Hydro-Proof. See Elkhart Rubber Wks.
Imperial Rubber Co., 220 Broadway, New York N. Y.
Impervo. See Canfield Rubber Co.
Ireo. See Imperial Rubber Co.
Johns-Manville Corp., New York, N. Y.
Jomanco. See Johns-Manville, Inc.
Kerite Ins. Wire & Cable Co., 30 Church, New York, N. Y.
Manson. See Okonite Co.
New York Insulated Wire Co., 114 Liberty, New York, N. Y.
Okonite Co., Passaic, N. J.
O. K. See Appleton Rubber Co.
P. & B. See Ruberoid Co.
Paratex. See Appleton Rubber Co.
Paruco. See Passaic Rubber Co.
Passaic Rubber Co., Clifton, N. J.
Plymouth Rubber Co., 1400 Revere, Canton, Mass.
Red-X. St. Louis Rubber Cement Co.
Relio. See United States Rubber Co.
Ruberoid Co., 95 Madison Ave., New York, N. Y.
S. I. See Superior Insulating Tape Co.
Slipknot. See Plymouth Rubber Co.
Star. See Sullivan & Sons Mfg. Co., J.
Sticka. See Graybar Elec. Co.
Stixwell. See Clifton Mfg. Co.
Sullivan & Sons Mfg. Co., J., 2224 N. 9th, Philadelphia, Pa.
Superior Insulating Tape Co., 3044 Lambdin Ave., St. Louis.
2-Plex. See Holdfast Rubber Co.
U. S. See United States Rubber Co.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago.
Victor. See Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Varnished Fabric
Acme Wire Co., New Haven, Conn.
General Electric Co., Section W-232, Merchandise Dept., Bridgeport, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New Jersey Wood Finishing Co., Woodbridge, N. J.
Radiotape. See Respro, Inc.
Respro, Inc., Wellington Ave. (Auburn), Providence, R. I.
Shield Brand. See Mitchell-Rand Mfg. Co.
Slco. See Standard Insulator Co.
Standard Insulation Co., East Rutherford, N. J.
Voltape. See Respro, Inc.



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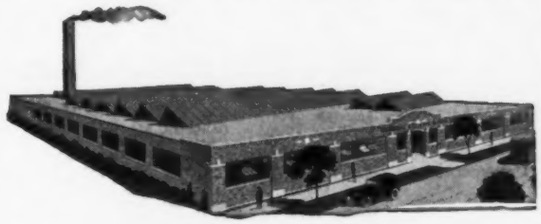

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Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Griswold Machine Co., George, New Haven, Conn.
Ridion Company, Frank, Boston, Mass.
Segur. See Electric Service Supplies Co.

TAPING MACHINES, Wire
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Wire Machinery Corp. of Am., New Haven, Conn.

TAPS. See Stocks, Dies and Reamers.

TENSION DEVICES, Coil Wire. See Racks, Wire Reel.

TENSION MACHINES, Band Wire
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.

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Low Tension, Secondary Terminals and Connectors.
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Bassett Metal Goods Co., Derby, Conn. (General Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Burton-Rogers Co., Boston, Mass.
Cabelug. See Jones, Howard B.
Clark Metal Products, 490 Hancock Ave., Bridgeport.
Dixie Supply Co., 91 7th Ave., New York.
Double Grip. See Pons, Eugene
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electron. See Bassett Metal Goods Co.
Fahnestock Elec. Co., East Ave. and 8th, Long Island City, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Ideal Clamp Mfg. Co., 198 Bradford, Brooklyn, N. Y.
Jones, Howard B., 2226 Wabansia, Chicago, Ill.
K. E. M. See Kuller Elec. Mfg. Co.
Kuller Elec. Mfg. Co., 575 Pierce Ave., Long Island City.
Morse Co., Frank W., Boston, Mass.
Nu-Way Snap. See Hatheway Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati, O.
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa.
Patton-MacGuyer Co., Providence, R. I.
Pons, Eugene, 927 Campbell Ave., Schenectady, N. Y.
Peterson Co., 7 Beverly, Providence, R. I.
Rajah Co., Bloomfield, N. J.
Salem Elec'l Supply Co., Salem, Mass.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Shure. See Burton-Rogers Co.
Tinkerbox. See Weber Elec. Wks.
Waterbury, Button Co., Waterbury, Conn.
Weber Elec. Wks., Brooklyn Sta., Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York.

TEST BENCHES, Armature
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Burton & Rogers Co., Boston, Mass.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Robart Bros. Co., Troy, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Pence & Son, H. O., San Luis Obispo, Cal.
Weidenhoff, Joseph, 4352 W. Roosevelt Road, Chicago, Ill.

TESTING INSTRUMENTS. See Instruments.

TESTERS, Coil
(Includes Armature Growlers, trouble shooters, and other portable testing devices). See also Instruments
Ace. See Weidenhoff, Joseph.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Ankenbrandt, J. J., 2140 Wakeman, Toledo, Ohio.
Armeter. See Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Bartlett Electric Products Co., Goshen, Ind. (Storage Battery).
Batt-O-Meter. See Indiana Mfg. & Elec. Co., also Case Elec.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Case Elec. Co., Marion, Ind.
Century Electrical Co., 102 Randall Ave., Syracuse, N. Y.
Chapman Elec'l Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Columbia. See Weidenhoff, Joseph.
Comparometer Co., New Ulm, Minn.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Economy. See Weidenhoff, Joseph.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Electrotest. See Comparometer Company.
Elimco. See Electric Machine Corp.
Ev-Ri-Test. See Weidenhoff, Joseph.
Forest Electric Co., 272 New, Newark, N. J.
Ga-Jit. See General Instrument Corp.
General Instrument Corp., 477 Broadway, New York, N. Y.
Herald Elec. Co., 29 East End Ave., New York, N. Y.
Hobart Bros. Co., Troy, Ohio.
Ideal. See Ankenbrandt, J. J.
Indiana Mfg. & Electric Co., Marion, Indiana.
Kietzman Electrical Mfg. Co., 234 N. Central, Gilman, Ill.
Leich Electric Co., Genoa, Ill.
Lundin Electric Machine Co., 10 Thacher, Boston, Mass.
Mallory Electric Co., Factories Bldg., Toledo, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Meco. See Metropolitan Mfg. & Elec. Co.
Metropolitan Mfg. & Elec. Co., 1163 Sedgwick, Chicago, Ill.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Paneltest. See Forest Electric Co.
Portometer. See Forest Electric Co.
Portostat. See Forest Electric Co.
Presto. See Metal Specialties Mfg. Co.
Reliable Parts Mfg. Co., Wellington, Ohio.
Rex Batrystat. See Bartlett Products Co.
Scout. See Leich Electric Company.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago, Ill.
Test-All. See Colpin Corp.
Test-O-Meter. See Weidenhoff, Joseph.
Test-Rite. See Colpin Corp.
Victory. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

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National Elec'l Inst. Co., 162 Sidney, Cambridge, Mass.
New York Testing Laboratories, 80 Washington, New York.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Stupakoff Laboratories, 6617 Hamilton Ave., Pittsburgh, Pa.

THERMO JUNCTIONS. See Instruments, Laboratory Standard.

THERMOSTATIC METAL
Chace Valve Co., W. M., 1600 Beard Ave., Detroit, Mich.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I.
Improved Seamless Wire Co., 775 Eddy, Providence, R. I.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Wilco. See H. A. Wilson Co.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

THERMOSTATS
American Thermostat Co., 238 Jelliff Ave., Newark, N. J.
Automatic Appliance Co., Jackson, Mich.
Bak-Rite. See Electric Appliance Mfg. Co.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia, Pa.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cobb Elec. Appliance Co., 100 Massachusetts Ave., Boston, Mass.
Cramblett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Diamond H. See Hart Mfg. Co.
Electric Automatic Appliance Co., Denver, Colo.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electric Maid. See Hankscraft Co.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Globe Mfg. Co., Battle Creek, Mich.
Hankscraft Co., 615 E. Washington, Madison, Wis.
Hart Mfg. Co., Hartford, Conn.
Hi-Lo. See Boston Machine Wks. Co.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Interstate Products Corp., 29 Commercial, Newark, N. J.
King. See Electric Heat Control Co.
Manhattan Elec'l Supply Co., New York, N. Y.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Moeller, A. E., 261 Sumpter, Brooklyn, N. Y.
Midget. See Coffin Mfg. Co., B. F.
National Steel Construction Co., 425 Fountenac, Seattle, Wash.
Pyratherm. See Federal Gauge Co.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Standard Thermometer Co., 65 Shirley, Boston 19, Mass.
Tagliabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Teeple Co., I. R., 540 E. 9th, Portland, Ore.
Thermolectric. See Bishop & Babcock Sales Co.
Thermosnap. See Spencer Thermostat Co.
Time-O-Stat Controls Co., Elkhart, Ind.
Trent Co., Harold E., 439 N. 12th, Philadelphia, Pa.
Visaflame. See Mercoid Corp.

TIGHTENERS, Commutator
Elmes Engineering Works, Chas. F., 222 N. Morgan, Chicago, Ill.

TIME SWITCHES. See Switches, Time.

TINNING TANKS, WIRE. See Wire Manufacturing Machines.

TINSEL. See Wire, Insulated.

TIPS, Cord
Duro. See McEvoy, C. H.
McEvoy, C. H., 430 Broadway, Lowell, Mass.
National Acme Mfg. Co., 7500 Stanton Ave., Cleveland, O.
Norden & Co., S. 180 S. Water, Providence, R. I.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.

TOOLS, Commutator Slotting. See Slotting Machines & Tools, Commutator.

TOOLS, Commutator Truing
Acme. See Green Equipment Corp.
Allen Elec. & Equipment Co., N. Pitcher St., Kalamazoo, Mich.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Central Mfg. Co., Fairfield, Ia.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Jordan Bros., 74 Beekman, New York, N. Y.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, Ohio.

TOOLS, Storage Battery
Battery Equipment & Supply Co., 7530 Greenwood Ave., Chicago, Ill. Burning Racks, Battery Trucks, Plate Pressers, Mallets, Lead Burners and Strainers.
Battery Parts Co., Inc., Wilkinsburg, Pa. (Leads.)
Battery Tools Co., 29 Willow, Montclair, N. J.
Beaco. See Battery Equipment & Supply Co.
Bobbett Elec. Mfg. Co., 811 E. 43rd St., Chicago, Ill. (Knife Heaters.)
Canedy-Otto Mfg. Co., 1816 McGee, Chicago Heights, Ill. (Floor Vises.)
General Elec. Co., Schenectady, N. Y. (Lead Burning Outfits.)
Heet-A-Knife. See Op-al Elec. & Mfg. Co.
Ibsco. See Illinois Battery Steamer Co.
Illinois Battery Steamer Co., Peoria, Ill.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati. (Terminals.)

Op-al Elec. & Mfg. Co., 1057 E. 30th St., Indianapolis, Ind. (Knife Heaters.)
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa. (Pillar Post Sleeves, Tongs, Reamers, Strap Punches, Terminal Pullers, Steamers, Racks or Stands, Terminal Post Shapers, Battery Analyzer, Post Sealing Machine, Plate Burning Press, Press and Stands.)
Pyratip. See General Elec. Co.
Reliable Parts Mfg. Co., Wellington, O. (Steamer and Still, Filler, Separator Cutter, Clips, Carrier, Post Cutter, Terminal and Cell Puller.)
Thompson Mfg. Co., Meadville, Pa. (Reamers, Terminal Post Pullers, Pressing Tongs.)

TORCHES AND FURNACES
Acetylene, Alcohol, Gasoline, Kerosene.
Bernz Co., Otto, Newark, N. J.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dreadnaught. See Wall Mfg. Supply Co.
Klein & Sons, Mathias, Chicago, Ill.
Lasher-Peerblow Co., 237 Harrison Ave., Boston, Mass.
McGill Mfg. Co., Valparaiso, Ind.
Peerless. See Lasher-Peerblow Co.
Staysalite. See Klein & Sons, Mathias.

TORPEDO Cord. See Twine.

TORSION BALANCES. See Instruments, Laboratory Standard

TRANSFORMERS
Radio. See Radio Circuit Components.
Gas Tube Sign. See Transformers, Oil Burner.
Oil Burner Ignition. See Transformers, Oil Burner.

TRANSFORMERS, Low and Intermediate Voltage
For Oil Burners, Gas Tube Signs, and other special purposes.
American Bosch Magneto Corp., Springfield, Mass.
American Transformer Co., Newark, N. J.
Campbell Elec. Mfg. Co., Lynn, Mass.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
Manhattan Elect. Supply Co., 17 Park Pl., New York, N. Y.
Sorgel Electric Co., 89 W. Water, Milwaukee, Wis.
Standard Transformer Co., Warren, O.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago, Ill.
Uptigraff Mfg. Co., R. E., First National Bank Bldg., Pittsburgh, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
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TRANSMISSION DRIVES. See Chain, Transmission.

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Segur. See Electric Service Supplies Co.

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TRUCKS, Armature. See Lifts, Armature.

TRUCKS, Factory Steel
Angle Steel Stool Co., Plainwell, Mich.

TRUING Devices, Commutator. See Tools, Commutator.

TUBE (Tubes) (Tubing) Adapters. See Radio Receiver Parts.
Brass. See Tubing, Brass.
Condenser. See Tubing, Brass and Copper.
Copper. See Tubing, Brass.
Cutters. See Stocks, Dies, etc.
Fibre. See Fibre.
Fibre Candle. See Candles.
Mica. See Mica.
Paper. See Tubes, Paper.
Platinum. See Platinum.
Pyrometer. See Cores, Resistance.
Refractory. See Cores, Resistance.
Radio. See Radio Vacuum Tubes.
Varnished Fabric. See Tubing, Varnished Fabric.

TUBES, Paper; Cores; Sleeves, Bushings
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Climax Tube Co., Mystic, Conn.
Klimaxcore. See Climax Tube Co.
McCausland, J. E., 86 Valley, Providence, R. I.
Pairpoint Corp., New Bedford, Mass.
Reliable Elec. Co., 3145 Carroll Ave., Chicago, Ill.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.
Stone Paper Tube Co., 33 O. N. E., Washington, D. C.
Textile Tube Co., Fall River, Mass. (Paper Sleeves.)

TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
Bull Dog. See National Elec. Products Corp.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., T. E., 54 Lafayette, New York.
Cook, Dunbar Smith Co., 85 Sprague, Providence, R. I.
French Mfg. Co., 128 Robbins, Waterbury, Conn.
Mueller Brass Co., Port Huron, Mich.
National Copper & Smelting Co., 1395 Coltman Rd., Cleveland, O.
National Electric Products Corp., Pittsburgh, Pa.
Randolph Clowes Co., Waterbury, Conn.
Relleum. See Mueller Brass Co.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Rome Brass & Copper Co., Rome, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Rome Turney Radiator Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa.
Summerill Tubing Co., Bridgeport, Pa.
Torrington Mfg. Co., Torrington, Conn.
United Wire & Supply Co., 1497 Elmwood Ave., Providence.
Wells Co., A. H., Watertown Ave., Waterbury, Conn.
Wolverine Tube Co., 1415 Central Ave., Detroit, Mich.

TUBING, Flexible Metallic
(Flexible Tubing.)
Almond Mfg. Co., T. R., Ashburnham, Mass.
American Metal Moulding Co., 140 Colt St., Irvington, N. J.
Auto-Brassflex. See National Metal Molding Co.
Auto-Steelflex. See National Metal Molding Co.
Breeze Corp., Inc., 24 S. 6th, Newark, N. J.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
National Elec. Products Corp., 1116 Fulton Bldg., Pittsburgh, Pa.

THERMOSTATIC METAL
For Low and High Temperatures
Our No. 1800 metal for temperatures up to 450° F.
Our No. 2800 metal for temperatures up to 1500° F.
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Adding Machines	Confectioner's Machinery	Humidifiers	Movie Projectors
Advertising Displays	Conveyors	Ironing Machines	Portable Tools
Air Compressors	Dental Lathes	Labeling Machines	Printing Presses
Baker's Machinery	Dish Washers	Oil Burners	Spray Equipment
Blowers	Driers	Office Appliances	Ticket Selling Machines
Brick Machinery	Floor Surfacers	Organ Blowers	Vacuum Cleaners
Churns	Folding Machines	Mailing Machines	Ventilating Fans
Cloth Cutters	Heaters	Machine Tools	Unit Heaters
Coffee Mills	Heat Regulators	Meat Choppers	Washing Machines
Coin Counters	Hoists	Milking Machines	Wrapping Machines

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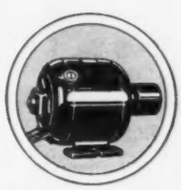

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TUBING, Flexible Metallic—Continued
Riflex. See United Metal Hose Co.
Sleeper & Hartley, Inc., Worcester, Mass.
Time-O-Stat Controls Co., Elkhart, Ind.
Titeflex Metal Hose Co., Newark, N. J.
Triangle Conduit Co., Dry Harbor Rd. and Cooper Ave., Brooklyn, N. Y.
United Metal Hose Co., 724 Garrison Ave., New York, N. Y.
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.

TUBING, Rubber
Rubber Tubing for Insulating Wire in Instruments and Telegraph Signal Lines.
Faultless Rubber Co., Ashland, O.
Forest City Rubber Co., 1276 Ontario, Cleveland, O.
Goodrich Rubber Co., B. F., Akron, O.
Tyler Rubber Co., Andover, Mass.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.

TUBING, Varnished Fabric
Insulating Tubing—Spaghetti.
Acme Wire Co., New Haven, Conn.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., William, 268 Fourth Ave., New York, N. Y.
Empire. See Mica Insulator Co.
General Electric Co., Section W-232, Merchandise Dept., Bridgeport, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Insulated Duct & Cable Co., Stokes, Trenton, N. J.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
Irvington Varnish & Insulator Co., Irvington, N. J.
Lee Tire & Rubber Co., Conshohocken, Pa.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky. (Insulated Waxed Cotton.)
Turbo. See Brand & Co.
Varflex Corp., Rome, N. Y.

TURNED-UP BOXES AND CABINETS. See Cabinets, Sheet Steel.

TWINE, Armature Winding; Torpedo Cord
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Winne & Son, Frank W., 42 N. Front, Philadelphia, Pa.

UNDERCUTTERS, Mica. See Slotting Machines & Tools Commutator.

UNITS, Refrigerator Condenser. See Condenser Units, Refrigerator.

UNITS, Rods and Grids, Resistance
Acme Elec. Heating Co., Dept. R, 1217 Washington, Boston.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa
Bradleyunit. See Allen Bradley Co.
Buffalo Products Co., Broome & Lafayette Sts., New York
Burger, J. P., 1813 Columbus Rd., Cleveland, O.
Calrod. See Edison Elec. Appliance Co.
Carter Radio Co., 2422 Prospect Ave., Chicago, Ill.
Chromalax. See Edwin L. Wiegand Co.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Crown Coloring & Chemical Co., 33 W. 17th, New York.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Dalton Elec. Heating Co., 287 Bridge St., Salem, Mass.
Dalton-Marsh Co., 88 Holten, Danvers, Mass.
Daric Co., 35 E. 21st, New York, N. Y.
Di-El-ite. See Wirt Co.
Dixon Crucible Co., Jos., Jersey City, N. J.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Edgewound. See Monitor Controller Co.
Edison Electric Appliance Co., 5600 W. Taylor, Chicago, Ill
Elec. Controller & Mfg. Co., 2700 E. 79th, Cleveland, O
Electro Thermal-Unit Co., 44 N. Fourth, Philadelphia, Pa
Elemite. See Louthan Mfg. Co.
Fits-All. See Eagle Elec. Mfg. Co.
Fitz-All. See Rodale Mfg. Co.
Fitz-Rite. See Rodale Mfg. Co.
Fix-All. See Witlow Elec. Mfg. Co.
F & M. See Hiram Marks Elec. Co.
General Electric Co., Schenectady, N. Y.
Globar Corp., Niagara Falls, N. Y.
Glo-Well. See Eagle Elec. Mfg. Co.
Gold Seal Elect. Co., 250 Park Ave., New York, N. Y
Hance-Parker Mfg. Co., Meriden, Conn.
Hankscraft Co., 615 E. Washington, Madison, Wis. (Oven Heater Unit.)
Hardwick, Hindle, Inc., 122 Greenwich, New York, N. Y.
Hexwound. See Monitor Controller Co.
Industrial Heater Co., 300 Canal, New York, N. Y.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa (Radio Resistance.)
Krischer's Mfg. Co., 255 Calyer, Brooklyn.
Louthan Mfg. Co., East Liverpool, O.
Marks, Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich
Monitor Edgewound. See Clark Controller Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
National Elec'l Supply Co., 1328 New York Ave., Washington, D. C.
Nelco. See Nelson Electric Co.
Nelson Electric Co., Plant City, Fla.
Northern Electric Co., 2833 N. Western Ave., Chicago, Ill.
Ogden Mfg. Co., 3947 Armitage Ave., Chicago, Ill.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ohm-Spun. See States Co.
Op-al Elec. & Mfg. Co., 1057 W. 30th, Indianapolis, Ind
Parker & Co., J. C., 407 Bulletin Bldg., Philadelphia, Pa
Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.

Heating Unit Service
Manufacturers—Designers
INDUSTRIAL HEATER COMPANY
300 Canal Street New York, N. Y.

Presto Products Co., 64 University Place, New York, N. Y
Prometheus Elec. Corp., 358 W. 13th, New York, N. Y.
Pyrox. See Westinghouse Elec. & Mfg. Co.
Reben Elec. Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Renuall. See Ogden Mfg. Co.
Repairall. See Waage Elec. Co.
Replaceall. See Waage Elec. Co.
Resistance Laboratories, Inc., 20 W. 22nd, New York, N. Y.
Ribohm. See Ward Leonard Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Security Elec. Mfg. Co., 2633 Canton St., Chicago, Ill.
Sedco. See Automatic Electric Heater Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa
Smoothwound. See Monitor Controller Co.
Snoco. See Snow & Co.
Snow & Co., E. W., Rochester, N. Y.
Super. See Northern Elec. Co.
United Metal Art Mfg. Co., 293 Wyckoff Ave., Brooklyn, N.Y.
Vitrohm. See Ward Leonard Elec. Co.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Warren Elec. Appliance Co., Warren, Pa.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegand Co., Edwin L., 420 1st Ave., Pittsburgh, Pa.
Wirt Co., 5221 Greene, Philadelphia, Pa.

VACUUM CLEANER BAGS. See Bags, Vacuum Cleaner

VACUUM DRYING & IMPREGNATING OVENS. See Ovens, Industrial.

VACUUM PUMPS. See Pumps, Vacuum.

VALVES, Electrically Operated
Asco. See Automatic Switch Co.
Automatic Switch Co., 154 Grand, New York.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., ft. of Tolman, Boston, Mass. (Water.)
Crane Co., S. Michigan Ave., Chicago, Ill.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Dual Automatic Valve Co., Rock Island, Ill.
Electric-Valve Mfg. Co., 68 Murray, New York, N. Y.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gas-Gard Co., 375 Main St., E., Rochester, N. Y. (Gas.)
General Electric Co., Schenectady, N. Y.
Golden-Anderson Valve Specialty Co., 1385 Fulton Bldg., Pittsburgh, Pa.
Liberty Electric Corp., Stamford, Conn.
Lunkenheimer Co., Cincinnati, O.
Minneapolis-Honeywell Regulator Co., Fourth Ave. & 28th, Minneapolis, Minn.
Northside Elec. Co., 4227 Spring Grove Ave., Cincinnati, O.
Protect-U. See Zisch Engineering Corp.
Reading Steel Casting Co., Bridgeport, Conn.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
St. Louis Motor Valve Co., St. Louis, Mo.
Tagliabue Mfg. Co., C. J., 18-83rd St., Brooklyn, N. Y
Teeple Co., L. R., 540 E. Ninth, Portland, Ore. (Gas.)
Time-O-Stat Controls Co., Elkhart, Ind.
Victor. See Lunkenheimer Co.
Zisch Engineering Corp., 39 Avenue L, Newark, N. J. (Gas.)

VARNISH. See Paint, Varnish, Lacquer.

VARNISHED TAPE. See Tape, Varnished Fabric.

VARNISHED TUBING. See Tubing, Varnished Fabric.

VOLT BOXES. See Instruments, Laboratory Standard.

VOLTMETERS. See Instruments.

VULCANITE. See Rubber, Hard.

VULCANIZERS, WIRE INSULATION
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Biggs Boiler Works, Akron, Ohio.

WASHERS, FIBRE. See Fibre.

WASHERS, Leather
Michigan Leather Washer Co., 548 E. Fort, Detroit, Mich.

WASHERS, Lock
Keystone. See Positive Lock Washer Co.
National Lock Washer Co., Newark, N. J.
Positive Lock Washer Co., Ave. A & Miller, Newark, N. J.
Shakeproof Lockwasher Co., 2513 N. Keeler Ave., Chicago.
St. Louis Malleable Casting Co., 7701 N. Conduit Ave., St. Louis, Mo.

WASHERS, Metallic
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Massachusetts Machine Shop, Inc., Boston, Mass.
New England Screw Co., Dept. A., 44 Farnsworth, Boston.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Wrought Washer Mfg. Co., 46 S. Bay, Milwaukee, Wis.

WATTMETERS. See Instruments.

WAX AND COMPOUNDS
Wax and Compound, Sealing and Filling.....See W
Junction Box, Potheads, Battery Tops, Bolt Head Holes
Wax and Compound.....See S
Saturating and Finishing, Braided Wire, Impregnating Fabric and Paper.
Chatterton's Compound .....See C
Ackurate Rubber Co., 25 Beaver, New York, N. Y. W . . . .
Ajax. See Sherwin-Williams Co.
Asphalt Products Co., 6531 S. State, Chicago.. . . S . .
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. C
Biwax Corp., 208 S. La Salle, Chicago, Ill.... W S . .
Black Nego. See Williams Co., F. M.
Bulls-Eye. See Zinsser & Co.
Candy & Co., 35th and Maplewood Ave., Chicago W S . .
Clifton Mfg. Co., 65 Brookside Ave., Boston.... . . . C
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. . . . . W S . .
Dolph Co., John C., 168 Emmet, Newark, N. J. W . . . .
Di Electric Puttie. See Ackurate Rubber Co.
Ever-Protect. See National Cable Compound Co.
Flake White. See Williams Co., F. M.
General Electric Co., Section W-232, Merchandise Dept., Bridgeport, Conn..... W . . .
Globe Chemical Co., Murray Road & Big 4 R. R. St. Bernard, Cincinnati, O..... W S . .
Goldo Brown. See Williams Co., F. M.
Great Lakes Thread & Yarn Co., 5133 Wesson Ave., Detroit, Mich..... W . . .
Hexsulate. See Tar Products Corp.
Imco. See Great Lakes Thread & Yarn Co.
India Red Seal. See Williams Co., F. M.
Insulatine Co., 1 Broadway, New York..... W . . .
Leverite. See Mitchell-Rand Mfg. Co.
Lime Seal. See Mitchell-Rand Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind..... . . . C
Mineralac Elec. Co., 1045 Washington Blvd., Chicago, Ill. ..... W . . .
Mitchell-Rand Mfg. Co., 19 Vesey, New York.... W S C
Mule-Hide. See Lehon Co.
National Cable Compound Co., Mitchell, Ind.... W . . .
National Wax Co., 189 W. Madison, Chicago, Ill. . . S . .
Nu-Blac. See Star Porcelain Co.
Par Flexo. See Williams Co., F. M.
Rubberseal. See Mitchell-Rand Mfg. Co.

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WAXES
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Paints and Varnishes
for every insulation purpose
41 years in the business. Write for samples of our latest finishing and saturating wax.
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Established 1887
432 Danforth Ave., Jersey City, N. J.

Rub-Flexo. See Williams Co., F. M.
Seidner & Enequist, Inc., 86 Hausman, Brooklyn, N. Y. ..... W . . .
Sherwin-Williams Co., Cleveland, O..... W . . C
Standard Varnish Wks., 433 4th Av., New York.. W . . .
Standard Wax & Import Co., 110 E. 42nd, New York, N. Y. ..... W S . .
Star Porcelain Co., Trenton, N. J..... W . . C
Tacrite. See Seidner & Enequist, Inc.
Tar Products Corp., Providence, R. I.
Trotter & Co., E. T., 576 Johnson Ave., Brooklyn, N. Y. ..... W S . .
Waverly Oil Wks., 54th and A. V. R. R., Pittsburgh, Pa. ..... S . .
Williams Co., F. M., 1238 Prospect Ave., Brooklyn, N. Y.
Zinsser & Co., 48 Vesey, New York, N. Y..... W . . .

WELDS, Lamp Lead-in. See Filaments, Incandescent

WELDING AND CUTTING OUTFITS
Electric Arc, Spot, Butt and Seam Metal Welders and Metal Cutting Outfits.
Acme Elec. Welder Co., 1850 W. Fulton, Chicago, Ill.
A. E. F. See American Electric Fusion Corp.
Agnew Electric Welder Co., Milford, Mich.
Allan Mfg. & Welding Co., Inc., 726 Washington, Buffalo.
Almanc. See Allan Mfg. & Welding Co., Inc.
Alternare. See Electric Arc Cutting & Welding Co.
American Elec. Fusion Corp., 2610 Diversey Ave., Chicago.
Ames Co., 115 Ninth, Brooklyn, N. Y.
Burke Electric Co., Erie, Pa.
Cushing Mfg. Co., 5617 Pacific Blvd., Los Angeles, Cal.
Dwyer Machine Co., Lynn, Mass.
Eisler Engineering Co., 756 S. 13th, Newark, N. J.
Electric Arc Cutting & Welding Co., 156 Jelliff Ave., Newark, N. J.
Electric Welding Co. of America, 744 Court, Brooklyn, N. Y.
Electric Welding Machine Co., 1530 Larned, E., Detroit.
Farwest Electric Welder Co., 1107 Northlake Ave., Seattle.
Fecteral Machine & Welder Co., Dana Ave., Warren, O.
Fleet-Weld. See Lincoln Elec. Co.
Fusion Welding Corp., 103rd St. & Torrence Ave., Chicago.
General Electric Co., Schenectady, N. Y.
General Engrg. & Supply Co., 160 5th Ave., New York, N. Y.
Gibb Welding Machines Co., Bay City, Mich.
Hansen. See Northwestern Mfg. Co.
Lincoln Electric Co., Coit Rd. and Kirby Ave., Cleveland.
McAdams Co., J. C., 912 Second Ave., Long Island City, Northwestern Mfg. Co., 480 Clinton, Milwaukee, Wis.
Plastic Arc. See Wilson Welder & Metal Co.
Pyrotip. See General Elec. Co.
Ryerson & Son, Jos. T., 2558 W. 16th, Chicago, Ill.
Seneca Electric Welder Corp., 5057 Woodward, Detroit, Mich.
Siemund Wenzel Electric Welding Co., 79 Hancock, Long Island City, N. Y.
Swift Elec. Welder Co., 2567 W. Grand Blvd., Detroit,
Taylor-Winfield Corp., Mahoning Ave., Warren, O.
Thompson Electric Welding Co., Lynn, Mass.
Una Welding & Bonding Co., 1615 Collamer Ave., Cleveland, O.
U. S. L. Battery Corp., Niagara Falls, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metal Co., Hoboken factory, Terminal Bldg., Hoboken, N. J.
Zeus. See Gibb Welding Machine Co.

WHEATSTONE BRIDGES. See Instruments, Laboratory Standard.

WINDERS
Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Coil. See Winding Machines, Armature & Field Coil.
Electromagnet. See Winding Machines, Induction Coil.
Filament. See Machines, Lamp Making.
Induction Coil. See Winding Machines, Induction Coil.
Loop. See Winding Machines, Armature & Field Coil.

WINDING MACHINES, Armature and Field Coil
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Conron, Frederick M., 177 New York Ave., Newark, N. J.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Globe Technolian Corp., Reading, Mass.
Fredericks Co., H. M., Lock Haven, Pa.
Handy. See Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Herald Elec. Co., 29 East End Ave., New York, N. Y.
Hunsdorf, Wm., 2056 E. Fourth, Cleveland, O.
Liberty Starter Co., W. Fort & Minnie Sts., Detroit, Mich.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Lyknu. See Fredericks Co.
Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio.
Mutual Foundry & Machine Co., Atlanta, Ga.
Onan, David W., 48 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Segur. See Electric Service Supplies Co.
Superior. See Armature Coil Equipment Co.

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Vitreous Enamel Electric Ovens
FREDERICK M. CONRAN
177 New York Ave., Newark, N. J.

MYSTERY

1/8
1/6
1/4
1/3
1/2
3/4
1

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Just a logical application of facts as determined by research and experience. Merely adherence to established principles and maintenance of proper building and inspection standards.

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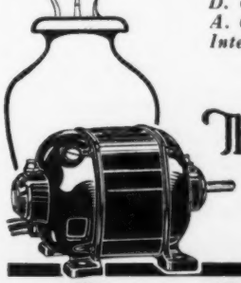
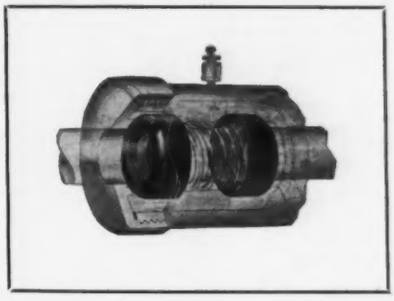
D. C. Compound
A. C. Polyphase Induction
Interchangeability of Frames



The Leland Electric Co.
Dayton, Ohio.
U. S. A.

Leland
fractional horsepower
Motors

This Ring Will Banish Your Stuffing Box Problems



So simple—so efficient—so necessary is the Cooke Seal Ring that in a short space of time nearly a quarter million have been sold—with universal satisfaction.

This ring maintains a leakless pressure or vacuum on a wide range of fluids, gases and air. It reduces friction 90%. It reduces motor load and does away with wear on the shaft, scoring and hot boxes.

This amazingly simple mechanical device absolutely prevents leaks around a rotating shaft because it is bound leak-proof and frictionally tight *on* the shaft and rotates *with it* instead of pressing against it. Thus a ground joint is formed against the gland having only 3/16″ of bearing surface.

The Cooke Seal Ring is simple in construction. Nothing can go wrong and there are a thousand places in industry where it can be, or is now being successfully used.

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Machinery Users:

Your local supply house will sell you Cooke Seal Rings to install in your present stuffing boxes. Or write us direct.

COOKE Seal Ring

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Dept. K

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—round and flat, fine wires, strip. Heat and acid-resisting castings. Special alloys. We can advantageously fill your requirements.
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"CUPRON"
RIVERSIDE AVENUE, NEWARK, N. J.

WINDING MACHINES, Induction Coil

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Conron, Frederick M., 177 New York Ave., Newark, N. J.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.
Easton Coil Co., Easton, Pa.
Electrical Products Mfg. Co., Providence, R. I.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Leesona. See Universal Winding Co.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Morris Register Co., 29th & Broadway, Council Bluffs, Iowa.
Radio Production Machinery Co., 212 Centre, New York.
Ridlon Company, Frank, 253 A St., Boston, Mass.
Universal Winding Co., Boston, Mass.
Weber & Scher Mfg. Co., 263 Sussex Ave., Newark, N. J.
Weehawken Engineering Co., 543 Gregory Ave., Weehawken, N. J.
WINDINGS. See Coils, Finished.

WINDOW SHADES, Factory

Athey Co., 6122 West 65th St., Chicago, Ill.
WIRE (Cable) (Cord), Aluminum. See Aluminum.
Copper Clad. See Wire, Copper Clad.
Forms. See Forms, Wire.
Frames. See Forms, Wire.
Fuse. See Fuses and Fuse Wire.
Molybdenum. See Molybdenum.
Phosphor Bronze. See Phosphor Bronze.
Platinum. See Platinum.
Radio Bus. See Wire, Bare.
Scrapers. See Scrapers, Wire.
Strippers. See Scrapers, Wire;
Tungsten. See Filament, Incandescent Lamp.

WIRE, Bare

	KEY
Armature Banding	See S
Copper Wire	See C
Iron Wire	See S
Phosphor Bronze	See R
Radio Bus Wire	See C
Resistance Wire	See R
Steel Wire	See S

Acme. See Alloy Metal Wire Co.
Advance. See Driver Harris Wire Co.
Alloy Metal Wire Co., Moore, Pa. ..... C R ..
American Brass Co., 25 Broadway, New York.
American Copper Products Corp., 233 Broadway, New York, N. Y. ..... C R ..
American Electrical Works (Philipsdale), Providence, R. I. ..... C ....
American Insulated Wire & Cable Co., Div. of General Cable Corp., 954 W. 21st, Chicago.... C .. S
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... C .. S
Anaconda. See American Brass Co.
Anylite Elec. Co., Fort Wayne, Ind. ..... C ....
Ballast. See Gilby Wire Co.
Baltimore Copper Mills (Div. of General Cable Corp.), Baltimore, Md. ..... C ....
Bassett Metal Goods Co., Derby, Conn. (General Sales Agent, Hatheway & Co., 16 Hudson, New York, N. Y. ..... C ....
Belden Mfg. Co., 2310B S. Western Ave., Chicago C .. S
Beldenite. See Belden Mfg. Co.
Bradford, Kyle & Co., Plymouth, Mass. .... R ..
Braidite. See Cornish Wire Co.
Brenvar. See American Insulated Wire & Cable Co.
Bridgeport Brass Co., Bridgeport, Conn. ..... C ....
Calido. See Driver Harris Wire Co.
Chromel. See Hoskins Mfg. Co.
Chromic. See Murray-Harris Wire Co.
Climax. See Driver Harris Wire Co.
Comet. See Driver Harris Wire Co.
Comin. See Gilby Wire Co.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I. C ....
Copel. See Hoskins Mfg. Co.
Copperweld Steel Co., Glassport, Pa. ..... C .. S
Cornish Wire Co., 30 Church, New York, N. Y.. C ....
Corwico. See Cornish Wire Co.
Crape. See Indiana Steel & Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J.. C ....
Cupron. See Gilby Wire Co.
Darow Mfg. Co., 97 Greene, New York, N. Y... C ....
Detroit Insulated Wire Co., Detroit, Mich. ..... C ....
1885. See Chicago Insulated Wire & Mfg. Co.
Driver Harris Wire Co., Harrison, N. J. .... R ..
Electron. See Bassett Metal Goods Co.
Excellicier. See Branford Elec. Co.
Fullman Mfg. Co., 1209 Jefferson, Latrobe, Pa. .. .. ..
Gilby Wire Co., Riverside Ave., Newark, N. J.... .. R ..
Goldmark Co., James, 83 Warren, New York.. C ....
Hope Webbing Co., Providence, R. I. (Braided Wire Tape) ..... C ....
Hoskins Mfg. Co., 4415 Detroit, Mich. .... R ..
Hudson Wire Co., Ossining, N. Y. ..... C R ..
Ideal. See Driver Harris Wire Co.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... C .. S
Indiana Steel & Wire Co., Muncie, Ind. .... S
Inland Wire & Cable Co., Sycamore, Ill. ..... C ....
Karma. See Driver Harris Wire Co.
Keystone. See Fullman Mfg. Co.
Lucero. See Driver Harris Wire Co.
Marion Insulated Wire & Rubber Co., Marion, Ind. C ....
Monarch Elec. & Wire Co., 622 W. Adams, Chicago C .. S
Monex. See Standard Alloy Wire Co.
National-Harris Wire Co., 113 Orchard, Newark.. .. R ..
Nehring Electrical Works, De Kalb, Ill. ..... C ....
Nichrome. See Driver Harris Wire Co.
Novar. See Standard Alloy Wire Co.
Page Steel & Wire Co., Bridgeport, Conn. .... S
Paranite. See Indiana Rubber & Insulated Wire Co.
Peerless. See Alloy Metal Wire Co.
Phillips Wire Co., Pawtucket, R. I. ..... C ....
Phono-Electric. See Bridgeport Brass Co.
Premier. See Alloy Metal Wire Co.

Providence Insulated Wire Co., Providence, R. I.. C ....
Race. See Ross Wire Co.
Resolute Wire Co., Hastings-on-Hudson, N. Y.... C ....
Roebling's Sons Co., John A., Trenton, N. J..... C .. S
Rome Wire Co., Div. of General Cable Co., Rome, N. Y. ..... C ....
Ross Wire Co., 69 Bath, Providence, R. I. ..... C ....
Silcrimp. See Valley Narrow Fabric Co.
Seneca Wire & Mfg. Co., Fostoria, O. .... S
Solar. See Gilby Wire Co.
Sparg Wire Co., J. A., Rome, N. Y. ..... C ....
Standard Alloy Wire Co., Elizabeth, N. J. .... S S
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa. ..... C ....
Super-Insulated Wire Co., Plymouth, Mass. ..... C ....
Superior. See Alloy Metal Wire Co.
Talking Tape. See Hope Webbing Co.
Therlo. See Driver Harris Wire Co.
Tophet. See Gilby Wire Co.
Tru-Lay. See Page Steel & Wire Co.
Valley Narrow Fabric Co., Falls, R. I.
Wheeler Insulated Wire Co., Bridgeport, Conn.. C ....

WIRE, Copper Clad

American Steel & Wire Co., 208 S. La Salle, Chicago, Ill.
Copperweld Steel Co., Rankin, Pa.
Standard Underground Cable Co., Pittsburgh, Pa.
WIRE SOLDER. See Solder, Bar and Wire.

WIRE DRAWING MACHINES

Drawing and Re-drawing Mill Equipment for Small Wires
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Sleeper-Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., 70 Franklin, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio.
Wire Machinery Corp. of Am., New Haven, Conn.

WIRE, Insulated

	KEY
Annunciator, Office, Bell Wire	See A
Asbestos Covered Heater Cord	See H
Asbestos Covered Magnet Wire	See M
Enameled Magnet Wire	See M
Fixture Wire	See R
Flexible Reinforced Heavy Duty Cord	See F
Heater Cord	See H
Ignition Cable	See R
Lamp Cord	See R
Magnet Wire	See M
Rubber Covered Wire & Cable	See R
Stove Wire	See H
Telephone Cord	See T

A-A Wire Co. (Div. of General Cable Corp), 420 Lexington Ave., N. Y. C.. R .. ..
A-1 Brand. See American Insulated.
Acme Wire Co., New Haven, Conn.
Enameled Silk, Cotton .... M
Amelectric. See American Elec.
American Brand. See American Insulated Wire & Cable Co.
American Brass Co., 25 Broadway, New York, N. Y. .... A .. M ..
American Copper Products Corp., 233 Broadway, New York, N. Y. ....
American Electrical Works (Philipsdale), Providence, R. I. .... M
American Enameled Magnet Wire Co., Muskegon, Mich. .... M
American Insulated Wire & Cable Co. Div. of General Cable Co., 954 W. 21st, Chicago, Ill. .... M
American Insulated Wire Corp., Div. of General Cable Co., 45 Baker, Providence, R. I. ..... R F .. A T ..
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... R F H A T M
Americore. See American Steel.
Amerite. See American Steel.
Amerize. See American Steel.
Amparak. See American Steel.
Anaconda. See American Brass Co.
Ansonia Electrical Co., Ansonia, Conn.
Silk, Cotton, Enameled .... A .. M
Armoriokt. See American Steel.
Bay State Insulated Wire & Cable Co., Paydras (Mattapan) 26, Boston..... R .. ..
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill. ..... R F H A T M
Beldenamel. See Belden Mfg. Co.
Beldenite. See Belden Mfg. Co.
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. ..... R F .. ..
Boston Insulated Wire & Cable Co., 65 Bay, Boston, Mass. ..... R F H .. .. ..
Bradford, Kyle & Co., Plymouth, Mass. .... M
Cablex. See Collyer Insulated Wire Co.
Celatsite. See Acme Wire Co.
Collyer Insulated Wire Co., Pawtucket, R. I. ..... R F H .. .. ..
Colorbeston. See General Elec. Co.
Condex. See Simplex Wire Co.
Colorubber. See Belden Mfg. Co.
Copperweld Steel Co., Rankin, Pa. ..... R .. ..
Cotenamel. See Belden Mfg. Co.
Cottonite. See Acme Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J. ..... R F H A T M
Darow Mfg. Co., 97 Greene, New York, R .. ..
Davis-Jones Insulated Wire Co., Pawtucket, R. I. ..... R F H A T ..
Deltabeston. See York Insulated.
Detroit Insulated Wire Co., Detroit, Mich. R .. .. .. T ..
Diamond Braiding Mills, Chicago Heights R F H .. .. ..
Dreadnaught. See Indiana Rubber Co.
Driver-Harris Co., Harrison, N. J..... R .. H .. .. ..
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.. .. .. M
Durabilt. See Tubular Woven.
Durscord. See Tubular Woven.
Durawire. See Tubular Woven.
Duro. See McEvoy, C. H.
Eagle. See Goldmark Co., James.
Eastern Insulated Wire Co., Tilton, N. H. R .. ..
1885. See Chicago Insulated Wire.
Enamelite. See Acme Wire Co.
Fibrex. See Simplex Wire Co.
Flexible Woven Cable Co., 755 Boylston, Boston, Mass. .... F .. ..
Flex-O-Cord. See Packard Elec. Co.
Garco. See General Asbestos Co.
Gavitt Mfg. Co., West Brookfield, Mass. .. .. T ..
GE-Flex. See General Elec. Co.
General Asbestos & Rubber Co., Charleston, S. C. .... H .. .. ..
General Elec. Co., Section W-232, Merchandise Dept., Bridgeport, Conn.... R F H .. .. M
Giant. See Collyer Insulated Wire.
Goldmark Co., James, 83 Warren, New York, Annunciator and Asbestos, Cotton, Silk and Enameled Magnet .... A .. M
Goodyear Rubber Insulating. See Graybar Electric Co.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y. R .. .. .. T ..
Grimshaw. See New York Ins.
Hatfield Rubber Wks., Inc., Hillside, N. J. R .. H .. .. ..
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.... R F .. A .. ..
Holyoke Co., 621 Broadway, New York.. R .. .. A .. M
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... R F H .. .. ..
Inland Wire & Cable Co., Sycamore, Ill. R W .. A .. M
I. X. L. See Collyer Insulated.
Kable. See Safety Cable Co.
Kenrite. See American Insulated.
Kertie Ins. Wire Cable Co., 30 Church, New York, N. Y. ..... R .. ..
Kilo, Co., 2 E. 23d, New York .... T M
Koelle, Frederick C., Real Estate Trust Bldg., Philadelphia, Pa. .... T ..
Liberty. See Nat. Metal Molding.
Lowell Insulated Wire Co., Lowell, Mass. R F H .. .. ..
Loxsteel. See Hazard Insulated Wire Works.
McEvoy, C. H., Lowell, Mass. ..... R .. .. .. T ..
Maring Wire Co., Muskegon, Mich. Cotton, Silk, Enameled .... M
Marion Insulated Wire & Rubber Co., Marion, Ind. ..... R F H A T ..
Massachusetts Elec. Mfg. Co., West Lynn, Mass. .... M
Monarch Elec. & Wire Co., 622 W. Adams, Chicago, Ill. .... A .. ..
Montgomery Co., J. R., Windsor Locks, Conn. .... T ..
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa. ..... R F H A T M
N. E. See Goldmark Co., James.
New England Wire Co., Westfield, Mass.. R .. H .. T ..
New York Insulated Wire Co., 114 Liberty, New York, N. Y. ..... R .. ..
Nitro. See Belden Mfg. Co.
O. K. See Phillips Wire Co.
Okocord. See Okonite Co.
Okonite Co., Passaic, N. J. ..... R .. ..
Onex. See Simplex Insulated Wire.
Packard Electric Co., Warren, O. ..... R F .. ..
Parac. See Phillips Wire Co.
Paracore. See U. S. Rubber Co.
Paraflex. See Bishop Wire & Cable.
Paranite. See Indiana Rubber.
Parkerite. See Seward Wire Co.
Paco. See Packard Elec. Co.
Philadelphia Insulated Wire Co., 200 N. Third, Philadelphia, Pa. .... H A T ..
Phillips Wire Co., Pawtucket, R. I. ..... R .. ..
Providence Insulated Wire Co., Providence R F H A .. ..
Raven Core. See New York.
Reliance. See American Steel.
Rockbestos Products Corp., Nicoll & Conner Sts., New Haven, Conn. ..... R .. H .. T M
Roebling's Sons Co., John A., Trenton, N. J. ..... R F H A T M
Rome Electrical Co., Rome, N. Y. .... M
Rome Wire Co., Rome, N. Y. ..... R F H .. T M
Ross Wire Co., 69 Bath, Providence, R. I.. R .. ..
Runzel-Lenz Elec. Mfg. Co., 1751 N. Western Ave., Chicago, Ill. .... T ..
Safety Cable Co. (Div. of General Cable Corp.), New York ..... R F H .. .. ..
Salamander. See York Insulated.
Seward Wire Co., Parkersburg, W. Va. R .. ..
Silkenamel. See Belden Mfg. Co.
Silkenite. See Acme Wire Co.
Simcore. See Simplex Wire.
Simplex Wire & Cable Co., 63 Sydney, Cambridge, Mass. ..... R F .. ..
Shield. See Ansonia Elec'l Co.
Spiralweave. See Hazard Ins. Wire
Standard Alloy Wire Co., Elizabeth, N. J. .. .. H .. .. ..
Standard Insulated Wire Co., Westfield, Mass. ..... R .. H .. .. ..
Standard Underground Cable Co., Pittsburgh, Pa. (Div. of General Cable.) R F H A T ..
Sterling. See Standard Underground.
Sterling Insulated Wire Co., Fall River, Mass. ..... R .. ..
Strand & Sweet Mfg. Co., Winsted, Conn. .. .. M
Super-Service. See Rome Wire Co.
Sweetstrand. See Strand & Sweet.
Tip-Top. See Standard Underground.
Tirex. See Simplex Wire & Cable.
Trenchlay. See Rome Wire Co.
Triangle Conduit Co., Dry Harbor Rd. & Cooper Ave., Brooklyn. ..... R .. ..
Tubular Woven Fabric Co., Pawtucket, R. I. ..... R F .. ..
United States Rubber Co., 1790 Broadway, New York, N. Y. ..... R .. H A T ..
U. S. Royal. See United States.
Varflex Corp., Rome, N. Y. .... M
Warrior. See American Copper.
Wheeler Insulated Wire Co., Bridgeport, Conn. ..... R F H A T M
White, J. M., 1128 Oliver, Philadelphia, Pa. ..... R F H .. T ..
Whitney Blake Co. See Graybar Electric Co.
Wovenite. See Flexible Woven.
York Insulated Wire Wks. of G. E. Co., 120 Broadway, New York, N. Y. ..... R .. H .. .. M

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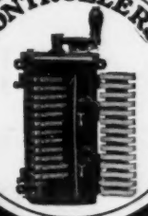

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Armoring Machines .....See A
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Bunching Machines .....See S
Covering Machines .....See I
Insulating Machines .....See I
Insulation Straining Machines.....See I
Measuring Machines .....See M
Park Cabling Machines.....See A
Saturating Tanks .....See F
Spooling Machines .....See U
Stranding Machines .....See S
Tinning Tanks .....See F
Winding Reels .....See U

Adamson Machine Co., Akron, Ohio.. I A . . . . . .
Aimco-Seward. See American Insulating Machinery Co.
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa. I A . . . S U F
Breguet. See American Insulating Machy.
Crescent. See Royle & Sons, John.
Durant Mfg. Co., 662 Buffum, Milwaukee, Wis. . . . . M . . U . .
Housatonic Machine & Tool Co., Bridgeport, Conn. . . . . I . . . . . U . .
Minneapolis Elec. & Construction Co., 80 S. 12th St., Minneapolis, Minn. . . . . M . . U . .
Nebuttco. See New England Butt Co.
New England Butt Co., 324 Pearl, Providence, R. I. . . . . I A B M S U . .
Peerless. See Royle & Sons, John.
Royle & Sons, John, Paterson, N. J. I . . . . . .
Sleeper & Hartley, Inc., Worcester, Mass. . . . . A . . . . S U
Terkelson Machine Co., 326 A St., Boston, Mass. . . . . M . . . . .
Textile Machine Works, Reading, Pa. . . . B . . . . . .
Universal Wire Machy. Co., 69 Daggett, New Haven, Conn. . . . . A . . . . . U F
Utility Mfg. Co., Cudahy, Wis. . . . . I . . . . . .
Wardwell Braiding Machine Co., Central Falls, R. I. . . . . B . . . . . .
Watson Mfg Co., Paterson, N. J.. I A . . M S . . F
Wire Machinery Corp. of Am., New Haven, Conn. . . . . M S U . .
Weir. See Housatonic Machine

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WIRE VULCANIZING MACHINES. See Vulcanizers Wire Insulation.

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Boxes. See Cabinets & Boxes, Wood
Cabinets. See Cabinets & Boxes, Wood
Pulleys. See Pulleys, Composition.
Woods Metal. See Radio Mountings.

WRAPPERS, Paper. See Boxes and Wrappers.

WRAPPERS, Tungsten Lamp. See Boxes and Wrappers.

WRAPPING MACHINES, WIRE. See Wire Wrapping Machines.

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Ryle & Co., Wm., 381 Fourth Ave., New York, N. Y.
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Smith & Dove Mfg. Co., Andover, Mass. (Linen Thread.)
Worcester Bleach & Dye Wks., Worcester, Mass.

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Horse Head. See New Jersey Zinc Sales Co.
New Jersey Zinc Sales Co., 160 Front, New York, N. Y.
Platt Bros. & Co., Waterbury, Conn. (Strips.)

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Franklin. See Grasselli Chemical Co.
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Illinois Zinc Co., Peru, Ill.
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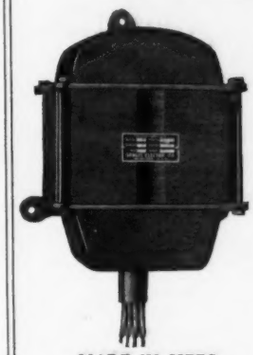

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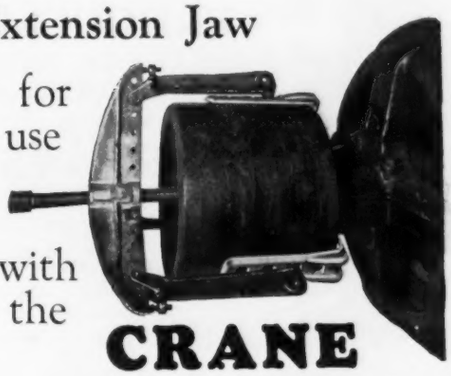

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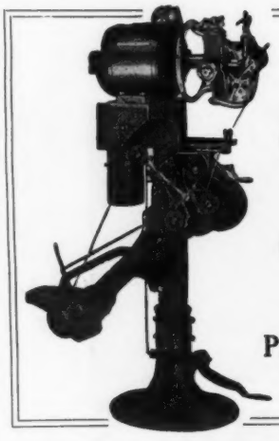

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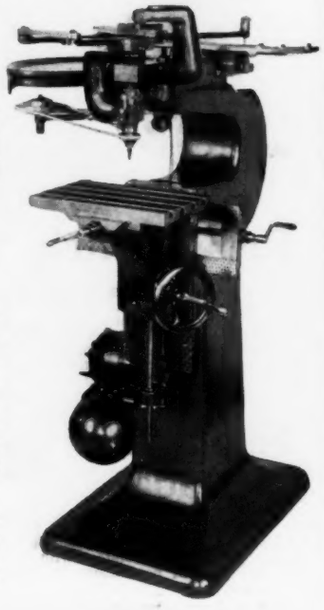

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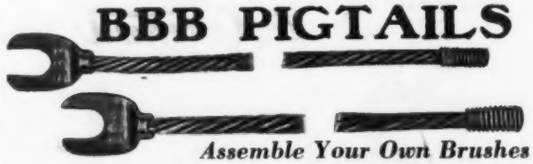

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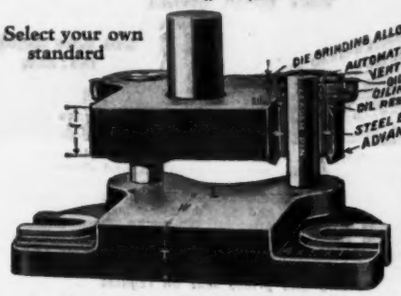

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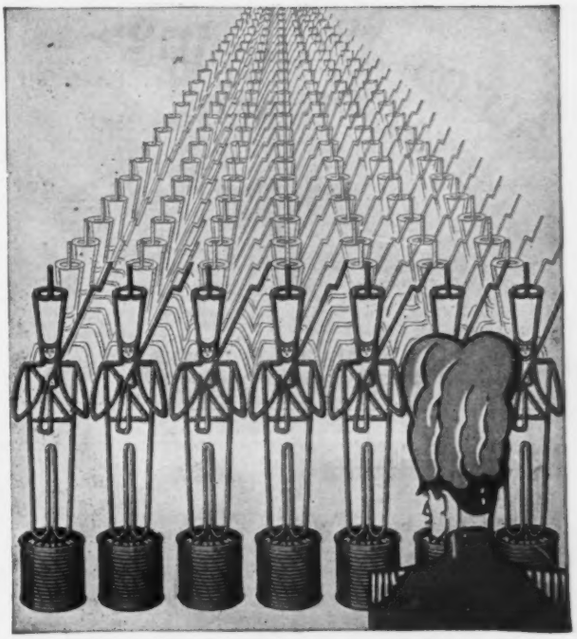

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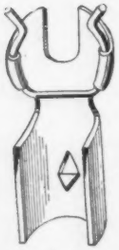

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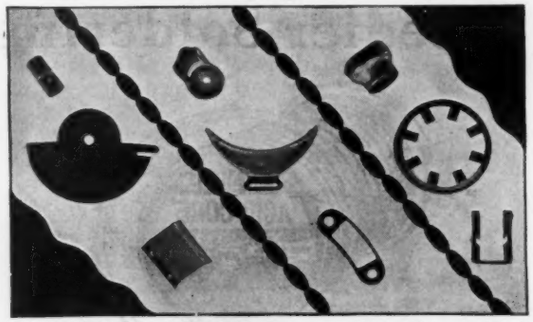

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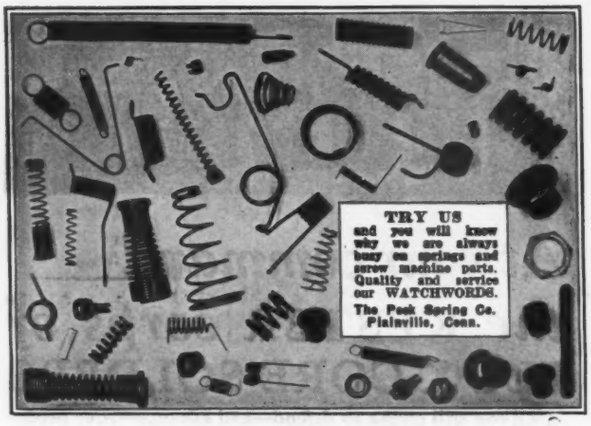
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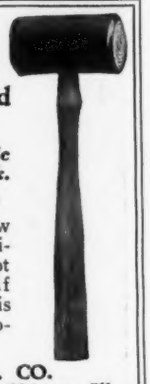

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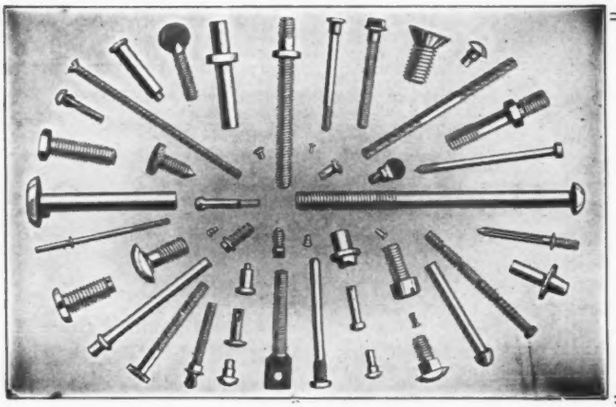

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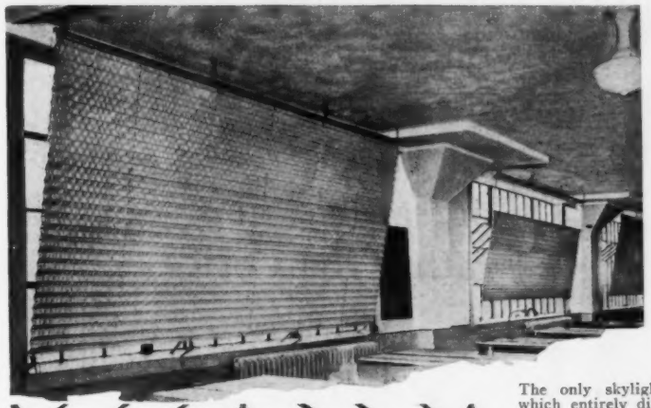

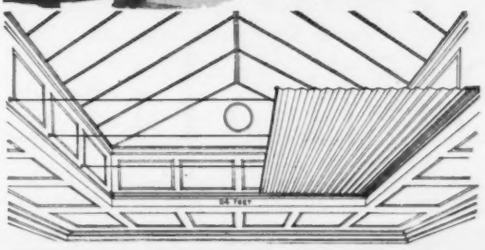

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We have been asked for the names and addresses of manufacturers of the items listed below:

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"Splendida" Electric Iron
"Sal Co. 176" Lamps
"Electron" Heating Pad
"Blaisdell" Automatic Electric Cigar Lighter
"L. R. Co." Receptacles
"Lily Wilson" Vacuum Cleaner
"Packard" Vacuum Cleaner
"Perkins" Siren
"Flint" Waffle Iron
"Vesodore" Cigar Lighter
"Graustark" Line of Lighting Fixtures
"Columbus - Universal" Electric Vacuum Cleaner and Floor Polisher
Manufacturers of Electric Incinerators
Manufacturers of Electric Driven Lamp Shade Lacing Machine

Replies from our readers to any of these inquiries will be greatly appreciated by ELECTRICAL MANUFACTURING, Printing Crafts Bldg., 461 Eighth Ave., New York, N. Y.

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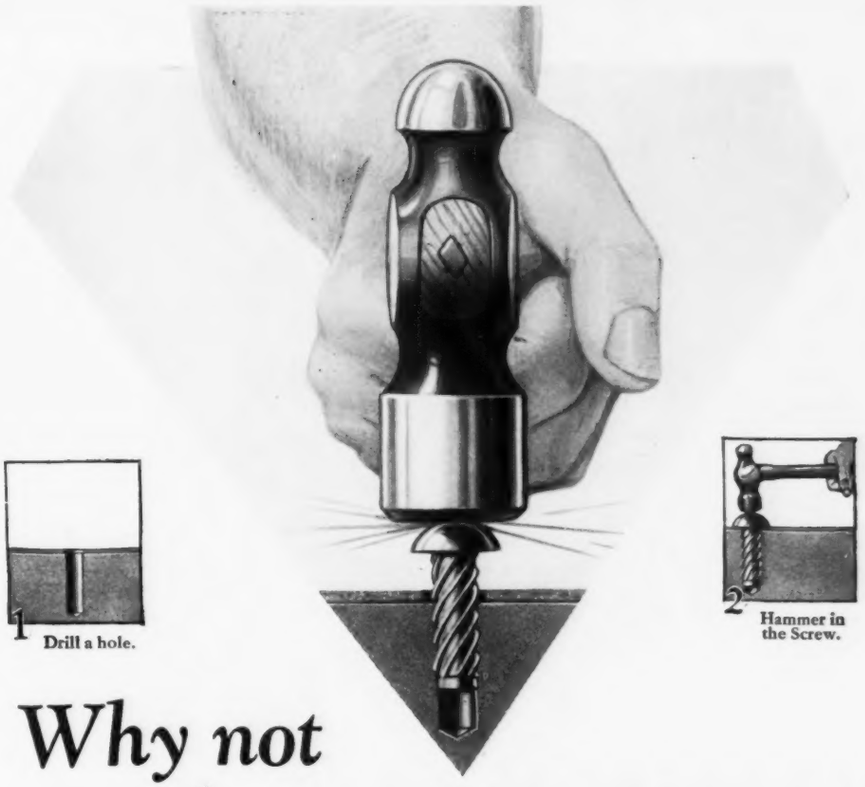

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